(continued from front flap)

against each of the presumed causes of Captain Scott and his companions' deaths. In particular, he demolishes the notions of extreme low temperatures, ferocious winds, and food/fuel shortages as the main causes of the disaster. Using neural network computer simulations, he proves that the Extreme Cold Snap, Never Ending Gale, and food/fuel scarcity never occurred.
By eliminating the alleged causes of the disaster, the author provides data and arguments that the deaths (Scott, Wilson and Bowers) were a matter of choice rather than fate. The choice was made long before there was an actual end of food/fuel and long before the end of the physical strength needed to reach delusive salvation at One Ton Depôt.

Printed in EC.
April 2016

Advance praise for
Captain Scott: Icy Deceits and Untold Realities

[A] Polish physicist Krzysztof Sienicki has recently challenged that view. abcNEWS

Dec. 18th, 2011
(reprinting an article by *Inside Science*).

I'm delighted to hear of your initiative and would enjoy hearing more … I have read your new book with great interest … Well done anyway. You've made a major contribution here.

Trevor Griffiths
English dramatist and author of the screenplay for the TV mini-series adaptation of Roland Huntford's *The Last Place on Earth.*

Of the numerous studies written about Robert Falcon Scott's Terra Nova Expedition, this lengthy book by Krzysztof Sienicki, a retired Professor of theoretical physics, with expertise knowledge in meteorology, will undoubtedly stand as the most exhaustive, best documented, and scientific oriented study thus far. Much as some experts may disagree with his conclusion - "that Captain Scott and his party committed altruistic suicide" - one can only admire the enormous amount of intense research, dedication, scientific rigor, and thorough treatment of the existing literature Sienicki has committed to this subject.

Ricardo Duchesne
Professor at the University of New Brunswick, Canada; author of *The Uniqueness of Western Civilization* (2011).

Once again, a responsible researcher and writer has delved into an Antarctic expedition to review records that provide additional information from a classic and well-known expedition. What is different in this case, though, is the evidence that appears to show a falsification of meteorological data from the original collectors, and then including explanation and correction of contemporary authors who have written about the same expedition. This apparent collision of interpretations is of great value in contributing to the history of an expedition by Captain Robert F. Scott, and introducing something that has not previously been made public. Every enthusiast of polar expeditionary history will find this book fascinating and worth a second look at how it compares with other versions of the same expedition.

Dr John Splettstoesser
Chair, Board of Governors, American Polar Society.

KRZYSZTOF SIENICKI: A theoretical physicist, currently retired, he was a Professor, visiting scholar and researcher at various universities in the US (Stanford and Akron University), Canada (Toronto and Montréal University) and his native Poland (Gdańsk University). He authored numerous scholarly research and review papers on theoretical aspects of quantum energy transport in disordered molecular systems. He also edited three volumes on molecular electronics. Professor Sienicki pre-printed and published research papers on Captain Scott's expedition as well as on self-organized criticality of winds in Antarctica.

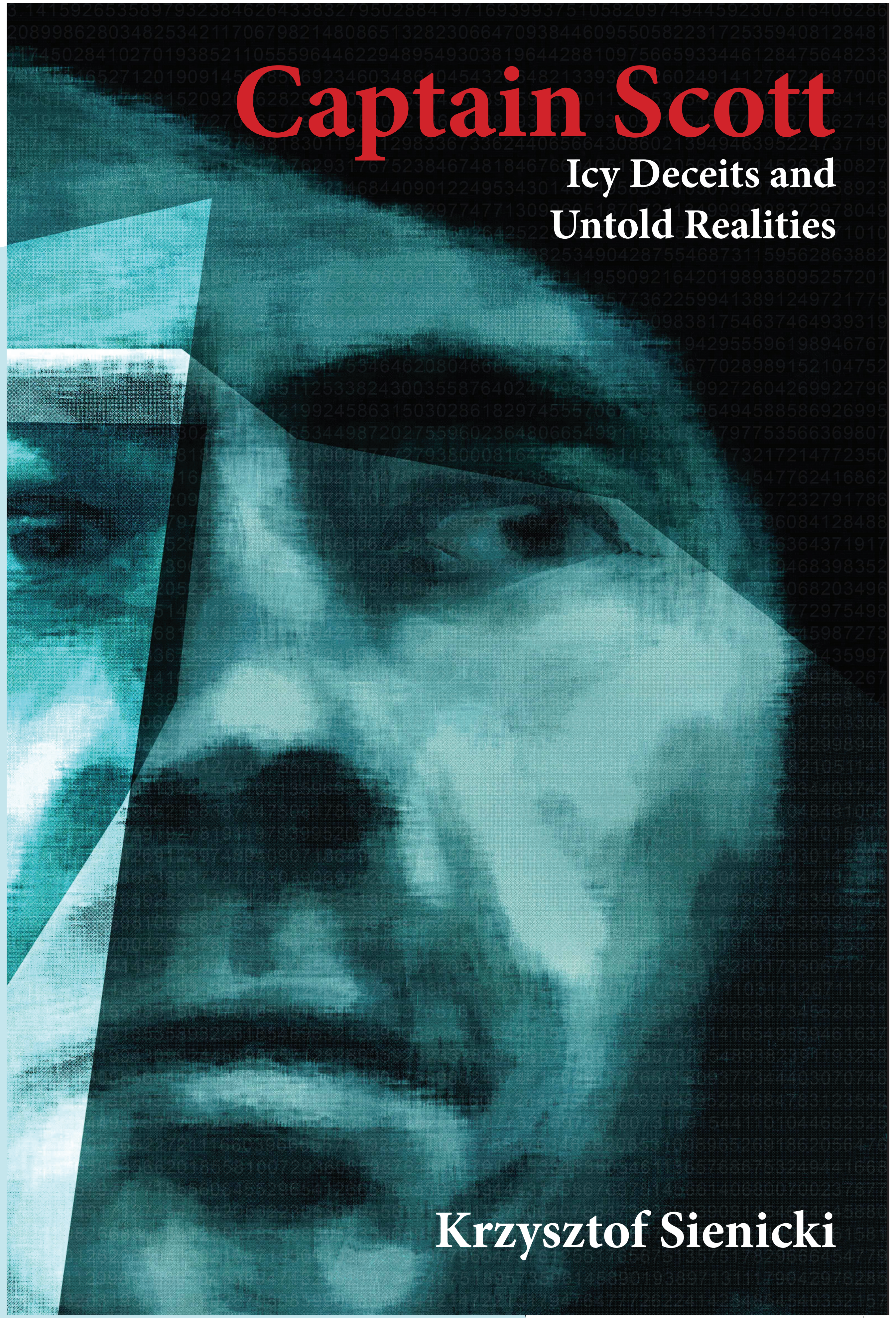
Open Academic Press Berlin-Warsaw

ISBN 978-83-944520-0-1
9 788394 452001

Krzysztof
Sienicki

Captain Scott
Icy Deceits and Untold Realities

OAP



£67.98/$94.31/€86.27

CAPTAIN SCOTT:
Icy Deceits and Untold Realities

Historical descriptions attempting to find a reason for Captain Scott and his companions' deaths were, despite eloquence of presentation, unable to find the actual cause of the disaster. While presenting Captain Scott's journey to the South Pole, the authors entirely neglected (ignored) fundamental (basic) issues of its logistics. In my book, I am delivering my verdict from digitizing the logistics of the South Pole journey and the weather conditions reported by Captain Scott and the shore party at Cape Evans. Based on that and subsequent analysis, an entirely new insight has emerged on all aspects of the journey and ultimate deaths of Captain Scott's party. This insight vitally challenges all previous scholarly work on the fate of Captain Scott's party.

By digitizing Captain Scott's journey to the South Pole, the author showed that all previously assumed causes of the disaster were insignificant compared to the psychological collapse of the expedition due to losing the race to Captain Amundsen's team.

This expertly written book is nothing less than a daring challenge to the prevailing views of Captain Robert F. Scott's journey to the South Pole and consequent disaster. Borrowing from various scientific disciplines, Krzysztof Sienicki lucidly argues

(continued on back flap)

Captain Scott: Icy Deceits and Untold Realities

Captain Scott

Icy Deceits and Untold Realities

Krzysztof Sienicki

Three Volumes Bound as One

Open Academic Press/Villa Europa
Berlin-Warsaw

Open Academic Press, Großbeerenstraße 2-10, 12107 Berlin, Germany, EC
Villa Europa Ltd., Sienna 64, 00-820 Warsaw, Poland, EC
http://www.openacademicpress.de/

First published in 2016

ISBN-10: 83-944520-0-0
ISBN-13: 978-83-944520-0-1

Cover design by Sever Sienicki
Typeset, printed and bound in EC

Dedication

I dedicate this book to the loving memory of my
dear parents,
Romualda and Franciszek,
who did not quite live to see it.

I also dedicate this book to my beloved wife
Urszula, my muse
and to our kids,
Mikołaj, Laurence, Kaja, Félix, Sever and Marcin.

Accursed be that tongue that tells me so,
For it hath cow'd my better part of man!
And be these juggling fiends no more believed,
That palter with us in a double sense;
That keep the word of promise to our ear,
And break it to our hope. I'll not fight with thee.

William Shakespeare, *Macbeth* 5.8.17-22

Contents

Volume II

Volume III

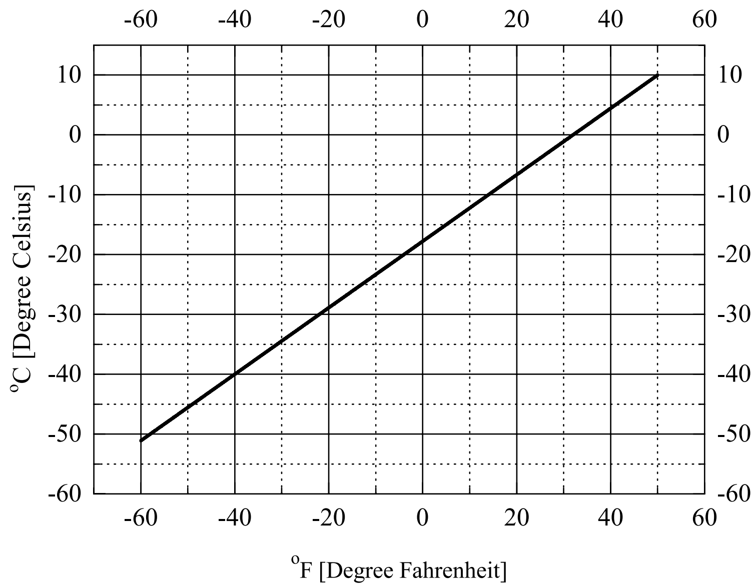
List of Figures, Maps and Art Works

List of Tables and Schemes

Author's Note

Temperature Scales. During the actual events described in this book, the British used the awkward Imperial units system. Since then the British (at least UK Met Office Oct. 15th, 1962) on the contrary to the Americans changed temperature readings from Fahrenheit to Celsius, thus duality in general perception of both scales was created.

The figure below provides graphical relationship between both scales in related to this book temperature range. For more precise calculations one may use the following equations [°C] = ([°F]–32) × $^5/_9$ or [°F] = [°C] × $^9/_5$ + 32 where [°F] and [°C] denotes given temperature in Fahrenheit and Celsius scales, respectively. One has to note that for *temperature intervals* rather than given temperature the following relation exists 1°F = $^5/_9$°C. Thus, say 2 Fahrenheit degrees *difference* in temperature means $^5/_9$ × 2°C = $^{10}/_9$°C ≈ 1°C *difference* and of course *vice versa*.



Distances. All distances in this book are given in geographical miles which are directly and conveniently related to finding geographical locations. One geographical (nautical) mile is equal to 1 minute of arc along the Earth's equator and almost

exactly 1 minute of arc in the polar regions. However, since in this book I was frequently performing various mathematical calculations it was more convenient to use for geographical locations (longitude and latitude) Decimal Degrees (DD) which are related to Degrees, Minutes, and Seconds (DMS) through the simple formula DD = D + M/60 + S/3600. Thus for example Cape Evans' coordinates {77°38′0″S, 166°24′E} are equivalent to {–77.633333, 166.4}.

Antarctica *vs.* Antarctic. It is commonly confused and assumed that the meaning of Antarctica and Antarctic are equivalent. Even Merriam-Webster and the Encyclopædia Britannica make a fuzzy distinction. In this book I used the term Antarctica as Earth's southernmost continent. The term Antarctic is used to describe a much wider area surrounding Antarctica south of the Polar Front (Antarctic Convergence).

Acknowledgements

This book was researched and written almost singlehanded. It was created during the long walks in the Mazovian forests and long hikes in the Tatra Mountains. Therefore, more than usually, the remaining confusions and errors are mine alone. Researching and writing this book has been my own exploration journey. My effort was supported by "all springs" to whom this book is dedicated. In particular to my wife Urszula, who has been, and remains, a source of encouragement and forbearance and who has encouraged me to "follow my bliss".

I wish to thank my colleague and friend Professor Leszek Kułak from the Department of Theoretical Physics and Quantum Informatics at the Technical University of Gdańsk, Poland for assistance with neural network simulations. I also wish to thank him for the never ending discussions about entangled issues of the first principles of quantum mechanics and equally entangled life questions. I am also grateful to former students Michał Wołowicz (M.Sc.) and Adrian Piasecki (M. Sc.) for handling enormous files of weather data.

Thank you, Sever, for book cover design and a number of illustrative figures.

Kristoffer Nelson-Kilger for all his knowledge, talent, hard work, patience and the eagle-eyed scrutiny in working with me on this book deserves my sincere appreciation. Thank you, Kristoffer!

After spending "years" in universities libraries, I wish to acknowledge my joy and thankfulness of using the digital library at https://archive.org/. However, I could not go without paper and I must thank, through Kristoffer's effort, the Rochester Public Library in Rochester, Minnesota, and all the libraries who have interlibrary loaned books to him to support my effort with the original figures here reproduced. Special praise is due to the University of Minnesota for their long loan times and their loaning of the 1968 facsimile of Captain Scott's diaries, and to the University of Wisconsin-Milwaukee for loaning a century-old copy of Albert Seward's *Antarctic Fossil Plants*.

Most of the works cited in this book's text belongs to the public domain. Every reasonable effort has been made to acknowledge the ownership of the copyrighted material included in this book. Any errors that may have occurred are unintentional, and will be corrected in subsequent editions provided notification is sent to the author and/or publisher.

Prolegomenon

Though secrets hidden are all forbidden
Till God means man to know.
We might be the men God meant should know
The heart of the Barrier snow

Edward A. Wilson[1]

Common sense inclines, on the one hand, to assert that every event is caused by some preceding events, so that every event can be explained or predicted. … On the other hand,… common sense attributes to mature and sane human persons… the ability to choose freely between alternative possibilities of acting.

Karl Popper[2]

It is of the highest importance in the art of detection to be able to recognize, out of a number of facts, which are incidental and which vital. Otherwise, your energy and attention must be dissipated instead of being concentrated. Now, in this case, there was not the slightest doubt in my mind from the first that the key of the whole matter must be looked for in…

Arthur Conan Doyle[3]

The good Christian should beware of mathematicians and all those who make empty prophecies. The danger already exists that the mathematicians have made a covenant with the devil to darken the spirit and to confine man in the bonds of Hell.

St. Augustine[4]

This book is about Captain Robert Falcon Scott (June 6th, 1868 – c. Mar. 29th, 1912) a British explorer of Antarctica. 2012 marked the centennial of his famous yet tragic *British Antarctic Expedition* of 1910, better known as the *Terra Nova Expedition* (1910–1913). Despite having the pretense of being partially a scientific research mission, the expedition's primary objective was to be the first to reach the geographical South Pole. The *Terra Nova Expedition* was the second expedition which Captain Scott undertook in Antarctica. As Commander Scott, during his first expedition to Antarctica, known as the *British National Antarctic Expedition* 1901–04, and later known as the *Discovery*

Expedition, he gained great experience in both managing and running extensive polar explorations.

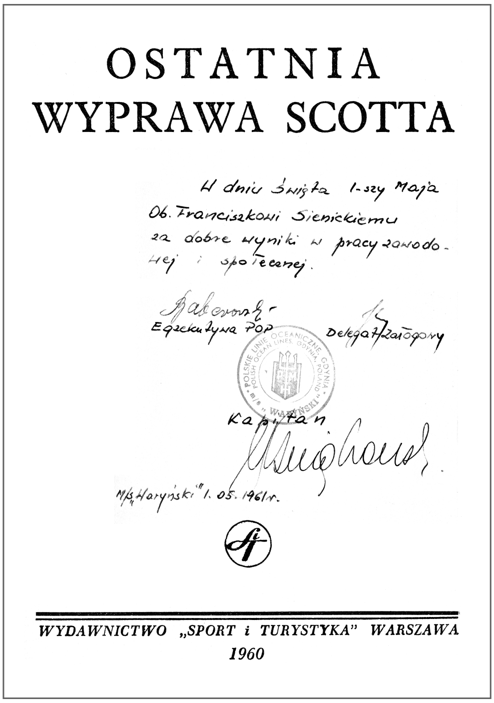
At about the same time that Captain Scott was organizing his *Terra Nova Expedition* (in the event that Ernest Shackleton failed to reach the South Pole), a Norwegian named Roald Amundsen (July 16th, 1872 – c. June 18th, 1928), following his successful traverse of the Northwest Passage (1903–1906) was looking further north to be first to arrive at the North Pole. However, his childhood dream was not to be fulfilled, as the American explorer Frederick Albert Cook claimed to have reached the North Pole on Apr. 21st, 1908. About one year later another American named Robert Peary also claimed to have reached the Pole on Apr. 6th, 1909. Shortly after Captain Amundsen's possibility of being the first to the North Pole in the minds of the public was taken by the American explorers Cook and Peary, he observed that "If the expedition was to be saved … If I was now to succeed in arousing interest in my undertaking, there was nothing left for me but to try and solve the last great problem – the South Pole."[5] However, Captain Amundsen kept his plans guarded and shared his change of Poles only with his brother Leon and his second-in-command, Lt Thorvald Nilsen.[6] The public and Captain Scott learned about Captain Amundsen's actual plans when the Norwegian's ship *Fram* borrowed from Dr Fridtjof Nansen, was beyond recall after leaving on Sep. 6th, 1910 from Funchal's quayside of Madeira in the Atlantic *en route* to the Bay of Whales in Antarctica.

Captain Scott's stoic and indifferent reaction upon receiving Captain Amundsen's telegram on Oct. 12th was in vivid contrast with the *Terra Nova's* crew's feelings on Captain Amundsen's actions, who described their discovery of this fact several months later as "the greatest geographical impertinence ever committed".[7] However, the telegram "Beg leave to inform you *Fram* proceeding Antarctic Amundsen" was sufficiently enigmatic to leave room for speculations to circulate of Captain Amundsen's actual intentions. It was not until Feb. 4th, 1911, when the *Terra Nova* under the command of Lt Campbell on her way to King Edward VII Land docked in the proximity of the *Fram* in the Bay of Whales, that the plans of Captain Amundsen were fully realized.

From then on, Captain Amundsen's intentions were crystal clear in spite of Captain Scott's wishful and contradictory thinking that "The proper, as well as the wiser, course for us is to proceed exactly as though this had not happened. To go forward and do our best for the honor of the country without fear or panic. There is no doubt that Amundsen's plan is a very serious menace to ours."[8] Effectively, the race to the South Pole was on.

The centennial of the expedition and the events which took place in Antarctica requires analysis of the actions of the actual participants in the ill-fated mission, which I have tried to do in this book. Today, we are equipped with over one hundred years of human progress and experience in global exploration. Therefore, one can now view from a new perspective Captain Scott's last expedition, its achievements, expectations, and declarations.

I came to the Captain Scott "theme" or "subject" quite late and in an unexpected way. I am not a British subject or in the commonwealth of the British crown. I am a theoretical physicist, who after a lifetime in academia indulged my curiosity of thinking about Captain Scott's expedition and work. Now, I know that in a transcendental way I was bound to work on Captain Scott. My first encounter with Captain Scott happened a long time ago when my father came home with a thick volume of


OSTATNIA
WYPRAWA SCOTTA

W dniu Święta 1-szy Maja
Ob. Franciszkowi Sienickiemu
za dobre wyniki w pracy zawodowej i społecznej.

Egzekutywa POP

Delegat Załogowy

POLSKIE LINIE OCEANICZNE GDYNIA
POLISH OCEAN LINES, GDYNIA, POLAND
m/s „WARYŃSKI"

Kapitan

M/s „Waryński" 1. 05. 1961 r.

WYDAWNICTWO „SPORT i TURYSTYKA" WARSZAWA
1960

the first edition of the *Terra Nova Expedition* journals in Polish. My dad was working through the ranks of a company named Polish Ocean Lines. Franciszek (for foreigners Frank) during his lifetime traversed many major seas and all the oceans. He was a hard worker and the company appreciated it. In 1961, he was rewarded with a Polish edition of Captain Scott's journals – *Ostatnia Wyprawa Scotta*.[9] During the years, the book somehow found its way from my parents to my library and rested there, hidden in between the mostly non-history volumes.

My first reading adventure in the polar regions occurred in 1986 when, totally weary with hard science reading and thinking, I grabbed by chance a hefty volume from one of the shelves of the Robarts Research Library at the University of Toronto. It was a graphite-colored volume of Alexander Mackenzie's *Voyages from Montreal through the Continent of North America to the Frozen and Pacific Oceans in 1789 and 1793*. A captivating read.

Since then, I have read and re-read most of the original books directly and indirectly related to polar exploration. From the beginning of my polar interest, I deliberately did not read modern accounts and analysis related to Arctic and Antarctic exploration. So it remained until 1999, when I was looking for physics-related papers published in the Proceedings of the National Academy of Sciences (USA). By chance, I found a scientific article written by two scholars, Dr Susan Solomon, and Dr Charles R. Stearns,[10] with the attention-grabbing title *On the Role of the Weather in the Deaths of R. F. Scott and his Companions*. However, the article proved to be short of my expectations conjectured from its title. The authors explained nothing. By then, my main objection was that in the paper the authors produced two different logical fallacies, called the gambler and affirmation of the consequent fallacies to prove forcefully

their *raison d'être*. The article contained also a number of mistakes. I reported these issues *via* snail mail to the authors. Because I did not receive a response, I composed a letter (a short article) to the editor of the proceedings with my comments on Drs Solomon and Stearns' paper. It is commonly accepted in the scientific community that different scholars may comment on articles in the form of Letters to the Editor published in the given journal. However, the possibility of Drs Solomon and Stearns responding constructively to my comments was cut short by the editor, who declined to consider the matter.

The paper, with its fallacious and hoaxed inferences, went mostly unnoticed by the public and general readership, who rarely or never ventured to read articles published in the Proceedings of the National Academy of Sciences (USA). But then in 2001, Dr Susan Solomon came up with the book *The Coldest March: Scott's Fatal Antarctic Expedition*. Dr Solomon's book, which was an extended form of the previously published article including its fallacious and hoaxed deductions, was widely acknowledged by the public and polar historians alike. Everyone has read it and no one could see the fallacious reasoning?

Those particular events sparked my further interest in Captain Scott's life and expeditions. As I read more and more about him, I was constantly amused at how his story was differently described by the authors. Like Dr Solomon, most of them declared something like "I seek balance in this book, and the honesty that I hope Scott himself would have wanted".[11] However, the question is: do data dragging and fallacious arguments fall under the category of balanced honesty? Why is there the need for a balanced book about Captain Scott? If nature (the Universe) was driven by equilibrium, then we as a species would not appear. There would be nothing but uniformly distributed atoms and particles.

But as I was digging, I figured out that most of the people were bluntly using Captain Scott for their own agenda. They were the members of Captain Scott's expeditions, the British establishment both during and after his life, historians, and the public.

The politicians used Captain Scott to influence people in order to save their jobs, positions, and income. The authors recycled Captain Scott's journals and used his exploration story to make an easy income. To justify interest in printing/purchasing the next book about Captain Scott, the authors referred to it as a balanced account of a real story. Sir Ranulph Fiennes, while debunking Huntford's *The Last Place on Earth* (originally published as *Scott and Amundsen*), went even further by arguing the Chewbacca defense[12] that a definitive Captain Scott biography can be presented *only* by a person "who has experienced the deprivations, the stress and the sheer physical pain that Scott lived through. Sir Ranulph has suffered all…"[13] Thus with one sentence, Sir Ranulph discarded all historians and their accounts of tyrants, mass murderers, *etc*. What is the value of a male historian writing about a female historical subject, according to him? One is forced to remember Milton Friedman's words, "Is there one of you who is going to say that you don't want a doctor to treat you for cancer unless he himself has had cancer?"[14]

Captain Scott's and Captain Amundsen's expeditions were definite events, which during the planning and executing stages were reduced to numbers: miles per day, calories per day, temperature, efficiency, work, friction, *etc*. Both explorers and the members of their expeditions, in different degrees of proficiency and expertise, transformed these numbers into everyday life and actions.

In modern terms, as we are accustomed to thinking the entire Universe is a digital machine,[15] polar expeditions may be digitalized and analyzed along these digital lines. Such an observation may be quite palpable for anyone who has ever planned a vacation trip, or an even more challenging self-sustained expedition. Indeed, the *Antarctic Manual*[16] issued in 1901 by the Royal Geographical Society was intended as a digital description of various aspects of the planned *Discovery Expedition*. Unfortunately, instead of promoting "accurate digits," the *Antarctic Manual* was a fairly random collection of different papers on various subjects related to the expedition. Sir Clements Markham was straightforward about his input[17]

> I planned an Antarctic Manual on the lines of the Arctic Manuals prepared for the expedition of 1875–76, securing the services of Mr. G. Murray as editor. It proved very useful, the first part containing instructions and information by leading men of science, and the second part being the narratives of Biscoe, Balleny, Dumont d'Urville, and Wilkes, with papers on polar travelling by Sir Leopold M'Clintock [*sic*] and on the exploration of Antarctic lands by Arctowski.

More importantly, the *Manual* was used by Sir Clements to promote his interests by selecting certain contributors, rather than a sound scientific and "digital" handbook. In particular, an article titled *Arctic Sledge-Traveling*[18] by Sir Francis Leopold McClintock reprinted in the manual, presented *incorrect values* of the sledging dogs food rations. The dog rations recommended by Sir Francis were *half* of what they should have been. This error of negligence by Sir Francis, Sir Clements, Murray, Captain Scott, and Lt Shackleton pushed the whole history of the British Antarctic exploration into the *Heroic* Age of Antarctic Exploration instead of into the *Grand* Age of Antarctic Exploration.

It seems that Captain Amundsen and his team were sufficiently skilled at keeping and following the right numbers. Captain Amundsen, unlike Captain Scott, was able to manipulate and use the right digits and calculate the relationships between them. He followed what I call 'fine tuned polar exploration' which included subtle digital values and their relationships between nature (physical and life) with human needs and actions. The fine-tuning occurred at different levels and to different degrees. For example, the natural velocity of sledging dogs is approximately equal to the natural human speed of skiing. By contrast, Captain Scott was content to simply test the vielocity of his transportation methods after the expedition had already begun.

Although Captain Amundsen's and Captain Scott's expeditions were primarily logistic undertakings, the fundamental aspects of these expeditions were neglected by historians, biographers, and hagiographers. Only a few specialized exceptions exist, scattered in professional journals. The majority of books concentrate on the nostalgic lamenting over the suffering of Captain Scott and his companions. Authors close their eyes to scientific analysis while arguing that Captain Scott's expedition was a primarily scientific expedition. The problem goes as far as data dragging, and/or attributing exaggerated data (increasing daily temperatures, wind vielocites, and its duration) to the *Terra Nova Expedition*. In the case of Dr Solomon's work, there even occurred open falsification of data to prove the author's point. However, Captain Scott's expedition data manipulation is not a risky business. As we will see, Leonard Huxley – editor of the first edition of *Scott's Last*

Expedition – got away with his falsification of Captain Scott's temperature records over one hundred years ago.[19]

Exploration and life in Antarctica are inevitably related to and dictated by the weather, its modes, severity, and apparent unpredictability. Then and now, only a small, weather dependent window of opportunity appears for humans to explore the vast Antarctic continent outside of heated habitations. The size of this opportunity is simply measured by air temperature, human endurance, and mileage to be crossed. If the distance traveled was to be extended, it meant endurance and organization had to be better; or as one would say, better performance on a personal and organizational level would be needed. The game to reach the South Pole was a performance game. We know the result: Amundsen first, Scott second. We know or at least assume to know that Captain Amundsen's trip to the South Pole was a flawless effort, and Captain Scott, on the contrary, suffered on many occasions.

However, as far as Captains Amundsen and Scott's expeditions and reaching the South Pole were concerned, it is useful to make a *cæteris paribus* assumption. The assumption is that, in spite of different methods, means, and human effort, both expeditions were able to reach the South Pole, and both teams were capable of returning safely to their base camps at Framheim and Cape Evans (Hut Point), respectively. This leaves the weather, understood as a combination of temperature and wind velocity, as the only *independent* variable.

I will just mention two related examples. The first is Captain Amundsen's premature attempt to reach the South Pole on Sep. 8th, 1911, which had to be abandoned due to extremely low temperatures. The extremities of these temperatures are not due to any *absolute* temperature values, but because the dogs could not withstand the impact.[20] The second example is the four-day blizzard, which struck Captain Scott's South Pole party at the foot of the Beardmore Glacier on Dec. 5th, 1911.

After examining the weather records of Captains Amundsen and Scott's South Pole parties, a list can be presented of temperature and wind velocity records measured on every day of their trip. Just by looking at the respective plots of temperature and/or wind velocity versus time, regular (expected) variations of these variables can certainly be observed. Even the above-mentioned four-day blizzard would fall into this ordinary category. Only two meteorological events described by Captain Scott would fall into the category of *extremely rare* weather events, sometimes called in power-laws jargon[21] *black swans*, *outliers*, *dragon-kings* or *rogue waves*, as observed by Lt Shackleton just before landing on the south shore of South Georgia Island.[22]

These black swan (extremely rare) events described by Captain Scott, followed each other. The first black swan event occurred on a February 27th through March 19th, 1912 – *Extreme Cold Snap*, and the second occurred on March 20th through 29th, 1912 – *Never Ending Gale* (Blizzard).

It seemed to me that gaining a better understanding of these two black swan events may be the central issue to reflect upon in Captain Scott's story. To think about these events, a need to practice with the digits was required, and due to my background and lifetime work in theoretical physics I did not feel shy. In particular, the wealth of meteorological data accumulated by manned and automated stations scattered across Antarctica guaranteed the possibility of careful scientific analysis. Obviously, the question of methods to be used in the analysis remained initially uncertain. However, I was confident and my experience as a physicist was telling me that something would

come up. The difficulty lies not in the new ideas, but in escaping the old ones. I think it was Louis Pasteur who said that chance favors the prepared mind, and I am asking the reader to take this with me on this investigative journey.

This book is a combination of analysis with certain scientific tools of several events during Captain Scott's *Terra Nova Expedition*, and an alarming review of the state of scholarship on Captain Scott. It is written for the layman. Because I will discuss a wide range of disciplines, the following text may sometimes be demanding. However, I wish to assure the readers that it will always be rewarding. Whenever I am presenting scientific concepts, in addition to my own explanation I provide references to the books of other authors who wrote on the particular subject. Thus, the investigative reader may easily undertake their own research in order to build a better and wider understanding of the presented arguments.

I came to the Captain Scott story without prejudice, and I researched the related questions as a scholar and as a scientist. I have used numbers that have no predefined bias. This work was carried out purely for scientific curiosity. In marked contrast to other books on Captain Scott, there was no support from his descendants, the Scott Polar Research Institute, or the Royal Geographical Society. I can only hope that I have presented my intellectual and scientific independence all the way to the last page of this book.

Krzysztof Sienicki

Podkowa Leśna (52°07′N, 20°44′E) or (52.11927, 20.73376)
Gliczarów Górny (49°20′N, 20°04′E) or (49.34290, 20.06739)
November 2015

Volume I

Chapter 1

General Introduction to the Earth's Air Circulation

big whirls have little whirls
that feed on their velocity
and little whirls have lesser whirls
and so on to viscosity

Lewis Fry Richardson[1]

Exploration and life in Antarctica are inevitably related to and dictated by the weather, its modes, severity, and apparent unpredictability. Then and now, a small weather window of opportunity appears for humans to explore the vast Antarctic continent. The size of this opportunity is simply measured by air temperature, human endurance, and mileage to be crossed. If the distance traveled is to be extended, it means endurance and organization had to be better, or as one would say, better performance on a personal and organizational level would be needed. The game to reach the South Pole was a performance game. We know the results. Captain Amundsen first, Captain Scott second. We know, or at least assume to know, that Captain Amundsen's journey to the South Pole was a flawless effort, and Captain Scott, on the contrary, suffered on many occasions only to perish at the end.

However, as far as Captain Amundsen and Captain Scott's expeditions and reaching the South Pole is concerned, it is useful to make a *cæteris paribus* assumption. The assumption is that, in spite of different methods, means, and human effort, both expeditions were able to reach the South Pole and both teams were capable of returning safely to the base camp at Framheim and Cape Evans *via* Hut Point, respectively. This leaves the weather, understood as a convolution of temperature and wind speed, as the only *independent* variable.

I will just mention two related examples. The first is Captain Amundsen's premature attempt to reach the South Pole on Sep. 8th, 1911, which shortly after had to be abandoned due to extremely low temperatures. The extremities of these temperatures were not due to any *absolute* temperature values, but because the dogs could not withstand the impact.[2] The second example is the four-day blizzard, which struck Captain Scott's South Pole party at the foot of the Beardmore Glacier on Dec. 5th, 1911.

This chapter is intended to serve several purposes. First, it contains a general overview of the Earth's air circulation and Antarctic meteorology which played an essential role in Captain Scott's expedition. Thus, several basic concepts are introduced. It is not necessary to have acquired an understanding of these concepts here in order to proceed. Some of the ideas presented in this chapter will be developed later. Thus, the reader may only look over this chapter and later return if the need arises.

Another purpose is to provide a self-contained introduction to meteorological phenomena which will play an important role later in this book. Thus, the intention is to explain these phenomena in this chapter before (or whilst) reading the later chapters.

1.1. Early Development of Atmospheric Circulation Knowledge

To measure a meteorological parameter like air temperature, atmospheric pressure, or wind direction is not a difficult task. Measuring and collecting meteorological data for a considerable time and a given geographical area is a little more demanding. However, forecasting methodological data is an extremely difficult task, not only from a mathematical point of view, but also from a psychological one.

The field of meteorology is closely related to physics, and it is classified as a branch of atmospheric sciences. Some would even say that meteorology as a scientific discipline is a branch of applied physics and chemistry. Indeed, a quick examination of the timeline of meteorology shows that the key researchers in the field were physicists like Daniel Bernoulli, Gaspard-Gustave Coriolis, and others. Meteorology focuses on studies of weather processes with a promise of forecasting. The original interest in forecasting had an economical reason, but nowadays it is a more social justification.

Human curiosity in predicting the future is inherent to our nature. The interest in knowing the future comes from our everyday concerns and eagerness to control our personal destiny. Most of us who express disbelief about apparent randomness in nature tend to think like Albert Einstein that "I, at any rate, am convinced that He [God] does not throw dice."[3] Einstein's judgment concerned the quantum world, where quantum phenomena are inherently probabilistic according to most physicists.[4] However, can we find in the macro world a deterministic relationship between its elements, or is the universe ruled by deterministic laws? This question, formulated at the very dawn of Western rationality, is still being asked twenty-five hundred years later. For most of that time, the question was a subject of philosophical analysis, but in the seventeenth century with Newton's discovery of the laws of nature, a new debate took place. Notably, a great French mathematician Pierre-Simon, marquis de Laplace, forecasted the fate of the Universe "We may regard the present state of the universe as the effect of its past and the cause of its future. An intellect which at a certain moment would know all forces that set nature in motion, and all positions of all items of which nature is composed, if this intellect were also vast enough to submit these data to analysis, it would embrace in a single formula the movements of the greatest bodies of the universe and those of the tiniest atom; for such an intellect nothing would be uncertain and the future just like the past would be present before its eyes."[5] This unspecified intellect, often referred to as *Laplace's demon*, was capable of observing the current state of the universe and forecasting its evolution.

Like the Laplacean demon in the physical word, there is Plato's political myth of an ideal, wise politician, and there is Mill's rational economic agent *homo oeconomicus*.[6] We now know that these ideas are illusory fictions. Mathematically, Laplace's demon, like a colossal computer without limitations, can store and calculate all necessary outputs from deterministic equations of an integrable Newtonian universe. In 1892, the remarkable French scientist, Henri Poincaré was aware that even in the smallest

Newtonian universe containing only three bodies, the calculation of trajectories is non-integrable, and can lead to completely chaotic trajectories of these bodies – deterministic chaos, as it was coined years later. Poincaré also noticed that small causes can have large effects, even if the system is not sensitive to initial conditions. This large effect may come from waiting a very long time. It was proved that Newtonian mechanics is neither completely regular nor completely irregular, but that the type of trajectory depends sensitively on chosen initial conditions.

While studying weather patterns using computer calculations, Edward Norton Lorenz noticed a critical dependence of the results upon the initial conditions which were necessary to be specified in order to run his program. Not long after this, Lorenz published his findings a seminal paper under the title *Deterministic Nonperiodic Flow*[7] in the *Journal of Atmospheric Sciences*. Using a remarkably simple set of three coupled first-order nonlinear equations, he showed that their solution leads to an equally remarkable and complicated dynamical object. He wrote, "For years, no single object would inspire more illustrations, even motion pictures, than the mysterious curve depicted at the end, the double spiral that become known as the Lorenz attractor."[8] The *Butterfly Effect* of the Lorenz paper had begun its dance.[9] Lorenz studied a model of turbulence during simulations of global weather patterns, and he did not simulate an atmospheric system ruled by the Laplace demon. The investigated model was dissipative. Roughly speaking, a dissipative system is a system in which initial energy can dissipate (convert) to heat, raising its temperature. In the case of Earth, the Sun warms its surface, which heats the atmosphere from below. Because outer space is colder than the atmosphere, it absorbs the heat accumulated in the air. The least dense warmest layer of air tries to rise, and the upper layer of air tries to drop to the Earth's surface. When an air mass rises, the pressure upon it decreases, so it expands and the temperature of the air mass decreases according to the basic laws of thermodynamics (gas laws). The competing warm and cold air masses correspond to circulation vortices sometimes called Bénard cells. Thus, Earth's atmosphere consists of a sea of three-dimensional vortexes in which spontaneous appearance depends on an external control parameter that can be tuned to critical values, causing a transition to chaos or emergence of order. Therefore, Earth's atmosphere as a whole represents a dissipative system, and all processes taking place in its limits are non-equilibrium processes. For us, primary examples of non-equilibrium processes are cyclones, hurricanes, and the katabatic winds frequently found in Antarctica. "Figuratively speaking, the matter at equilibrium, with no arrow of time, is "blind," but with the arrow of time, it begins to "see." Without this new coherence due to irreversible, non-equilibrium processes, life on earth would be impossible to envision. The claim that the arrow of time is "only phenomenological," or subjective, is therefore absurd. We are actually the children of the arrow of time, of evolution, not its progenitors."[10] Thus, fine-tuning of certain parameters of the universe may lead to the emergence of life forms via non-equilibrium processes, and the Laplacean demon should rest on library shelves.[11, 12]

For theoretical physicists, it is an everyday ritual to develop and investigate grand ideas and theories. But for a practitioner, as for instance a meteorologist, more concrete workable theories and models are essential in analyzing and forecasting weather. Therefore, one has to remove the dust from Laplace's demon and use it, in spite of the obvious fallacy of his description that "nothing would be uncertain".[13]

The first noteworthy steps in this direction were developed by the Norwegian physicist currently regarded as a father of weather forecasting, Vilhelm Bjerknes, and presented in 1910 in his extraordinary treatise *Dynamics Meteorology and Hydrology*.[14] The volume contains two books: Part I: *Statics* and Part II: *Kinematics*. In Part I, which is indeed a lengthy introduction to Part II, Bjerknes and J. W. Sandström present an overview of the definitions and practical solutions to static meteorological and hydrographical problems. The real objective of the treatise is revealed in Chapter I of Part II, written together with Th. Hesselberg and O. Devik. The chapters in this part and the general program of its development are valid even today.

The authors state that "For the description of atmospheric states … consider at least five fields, those of pressure, of mass, of temperature, of humidity, and of motion," and "concisely state the problem of meteorology and hydrographical: To investigate the five meteorological and the five hydrographic elements as functions of coordinates and time."[15] In order to conduct their studies, they used a "dynamic method" described in the laws of thermodynamics and hydrodynamics. Following that, the authors identified that "general investigations according to the dynamic plan must lead to occupation with three special problems," which include:

- Organization of observations:
  - the principle of simultaneity,
  - distribution in space,
  - distribution in time,
- Diagnosis of atmospheric or hydrospheric states,
- Prognosis of future states.

The meaning of the first two organizational and diagnostic problems is transparent. Only the last one needs some additional explanation[16]

> The Problem of Prognosis. – The present state being diagnosticated, the final problem is that of the precalculation of future states. The solution of this problem will involve the simultaneous use of all intrinsic relations of hydrodynamic and thermodynamic origin, to be used in connection with the initial conditions, the surface conditions, and data regarding exterior effects of terrestrial or cosmic origin. Evidently the problem is of enormous complexity. But in order to try to prepare its solution, we shall solve one by one a series of partial problems belonging to it. For every equation introduced we shall examine its prognostic as well as its diagnostic value. In kinematics, we shall meet with the first partial problem of prognosis, for the definition of the fundamental kinematic vectors involves the idea of time. When we know the instantaneous velocity of a moving particle, we shall know the place of this particle a differential of time later. The changes of place of the moving particles can therefore be determined in the first approximation by purely kinematic principles. The solution of this problem of kinematic prognosis is the first step in the solution of the general problem. During the work with the problem of prognosis, it will be apparent that while we are probably in possession of all the intrinsic relations to be used for its solution, certain empirical data required for bringing them into application must be sought. The missing data can in many cases be found by reversing the

> problem of prognosis. The state being known at two epochs, we calculate the missing data, which, used in the intrinsic relations, should allow us to calculate the second state when the first is given. Having this method in view, we shall treat the different partial problems of prognosis both in direct and in inverse form. Reversing the problem of kinematic prognosis, we shall thus arrive at the purely kinematic determination of accelerations. When we determine afterwards the same accelerations by dynamic principles, we get the opportunity of finding the value of a term in the dynamic equation, of which we have not a priori a sufficient knowledge, namely, of that representing frictional resistance.

Bjerknes' program was extraordinary in every respect, and all he needed was a Laplace demon capable of numerical solutions of his differential equations. For that purpose, Sandström constructed an Integration-Machine which was used in the respective meteorological calculations, including an Indian Southwest Monsoon, North America on Nov. 28th 1905, and Europe on Jul. 25th, 1907. After the careful presentation of the results, Bjerknes observed "If the observations were performed according to the plan which we have developed in Chapter I, we should be able to work out complete diagnoses at epochs which were sufficiently near each other to allow us to derive also the fields of acceleration within all atmospheric sheets. This would be the first step in opening the way for serious investigations in atmospheric dynamics."[17]

This last remark had a different meaning one hundred years ago than it does now. The insufficiency of data for Bjerknes' analysis was due to weather data and the nature of differential equations used in prognosis. Each of these equations contains time and space differentials, which represent infinitesimal changes of time and space. For approximate calculations, the distance between weather stations should be sufficiently small and the periods between observations should be satisfactorily small. Neither of these conditions was fulfilled in the observations available for Bjerknes' analysis.

Twelve years later, in a book summarizing previous research, Lewis Richardson argued that for prediction of meteorological data, it would be better to "proceed by way of numerical tables. The reason for this is that … the arithmetical procedure is the more exact and the more powerful in coping with otherwise awkward equations. Graphical methods are sometimes elegant when the problem involves irregularly curved boundaries. But the atmospheric boundary, at the earth, nearly coincides with one of the coordinate surfaces, so that graphs would have no advantage over arithmetic in that respect."[18] Although Richardson had made some substantial improvements over Bjerknes' analysis, he also encountered a problem of computing efficiency, the cascading growth of errors during computations, and the underappreciated nature of our atmosphere where there is a certain balance between winds and pressures. In the last chapter of his book, he explained, "It took me the best part of six weeks to draw up the computing forms and to work out the new distribution in two vertical columns for the first time … With practice, the work of an average computer might go perhaps ten times faster."[19] One should note that the word computer is used here in its original sense: a person who did computation, not a machine. However, to compute the weather for the whole globe, Richardson would have needed 64,000 computers.[20] "That is a staggering figure," continued Richardson, "Perhaps in some years' time it may be possible to report a simplifica-

tion of the process. But in any case, the organization indicated is a central forecast-factory for the whole globe, or for portions extending to boundaries where the weather is steady, with individual computers specializing on the separate equations."

Suggestions by Richardson's computing method allowed Richard Feynman years later to do the respective calculations to construct the first atomic bombs at Los Alamos.

Since the time of these first investigations, we have made great progress in computing power, but essentially the same principles are running on supercomputers. With ever increasing computing power, our appetite for faster, more exact, and more complicated meteorological models was and is growing even faster.[21] Richardson's frustration that weather fronts are moving faster than the slow processes of computing them is still present and provokes scientific proposals for yet more computational speed. Nevertheless, the books of Bjerknes and Richardson remain as tutorials in meteorology. The First World War delayed publication of Richardson's work, and to publish a manuscript "an application was made to Dr G. C. Simpson, F.R.S., for a further grant in aid, and the sum of fifty pounds was provided by the Meteorological Office."[22] The generous supporter was the newly appointed and the longest serving (1920–38) Director of the Meteorological Office in London, Dr George Clarke Simpson.[23] At the age of 23, he was selected by Professor Shuster to join Scott's *Discovery* expedition but failed a medical examination.[24] However, almost ten years after that, he joined the *Terra Nova Expedition* as a meteorologist, and by a further ten years after its conclusion had published the expedition's collections of all meteorological data.[25] In this book, I will frequently rely on Dr Simpson's collected meteorological data from the *Terra Nova Expedition*. For Dr Simpson's role in this expedition, see section 10.1.

The energy that drives the atmosphere is obtained from the sun's direct radiation. The origin and intensity of solar radiation are indeed complex phenomenona, and have been subjects of interest since the dawn of mankind. The most descriptive account was given by Prussian philosopher Immanuel Kant in his book *Universal Natural History and Theory of the Heavens*[26]

> Now, if the sun, or rather suns in general, are flaming spheres, then the first requirement of their outer surfaces, which we can deduce from this point, is that air must be found on them, because without air no fire burns. This condition gives rise to remarkable consequences. For, first of all, if we first establish the atmosphere of the sun and its weight in relationship to the sun's cluster, how compressed will this air be and how capable will it become on account of this very compression to maintain the most intense level of fire through its elasticity. According to all assumptions, in this atmosphere, the clouds of smoke from the materials broken up by the flames (which, we cannot doubt, have a mixture of coarse and lighter particles in them), once they have risen up to an altitude which keeps the air cooler for them, fall down with heavy rains of pitch and sulphur and provide new fuel for the flames. This very atmosphere is also, for the same reasons as on our Earth, not free from the motions of the winds, which, however, according to this view, must far exceed in intensity everything that the power of the imagination can merely picture. When some region or other on the surface of the sun, either through the suffocating force of the vapours pouring out or because of the

> limited supply of combustible material, sees the eruption of flames diminish, then the air above cools to some extent, and since it is contracting, makes room for the air in the immediate vicinity to rush into its space with a force proportional to its expansion and to re-ignite the extinguished flames.

Indeed, in 1755, Kant's argument that "without air no fire burns" seemed very plausible, and was supported by every-day experiences. Additionally, Kant in the following arguments could account for observations of sunspots described by Galileo in his published 1613 work entitled *Letters on Sunspots*. Kant observed[27]

> Lastly, let us now bring near, as it were, to the imagination such a marvellous object as a burning sun is. At a glance we see vast seas of fire which raise their flames to the sky; raging tempests whose fury doubles the violence of the flaming seas, and makes them swell and overflow their shores, till they now cover the elevated regions of the solar body, and again make them sink back into their bounds; charred rocks which stretch their fearful peaks up out of the flaming abysses, and which, when flooded or exposed by the waves of fire, cause the alternating appearance and disappearance of the sun spots; dense vapours which suffocate the fire, and which, lifted by the violence of the winds, produce dark clouds which plunge down again in sheets of raining fire, and then pour themselves as burning rivers from the heights of the solar land into flaming valleys. And all this accompanied with the crashing of the elements, the down rush of burned-out matter, and nature the while struggling with the power of destruction amid the awful horrors of her overthrow, yet working out the beauty of the world and the utility of the creatures.

Although the details of sunspot generation and nature are still a matter of research, from our perspective and interest, two fundamental properties of the sun are important. The first is that the change of solar radiation has cyclic properties, with a basic cycle of about 11 years. The second fundamental property, which I will explore in more detail in the following chapters, is that the Sun shows the state of self-organized criticality.[28]

At this moment, however, let me return to the description of atmospheric air circulation on Earth. Since the mean temperature of the Earth is changing within certain bounded limits, it follows that the energy gained from the Sun must be sent back to space. The fraction of incident solar radiation that is reflected by Earth is called albedo, meaning *the whiteness* in Latin. It is assumed that a perfectly white surface (body) would reflect all incoming radiation, and thus its albedo is 1 (or 100%). An idealized black surface (body) would absorb all incident electromagnetic radiation. The studies of black body radiation led to the development of much of modern physics.[29]

Earth's albedo was not actually appreciated by the general public until the publication of Apollo 8's (December 1968) first and celebrated pictures of a blue and white Earth set against dark black space. Measuring Earth's albedo is difficult. The local albedo is dependent upon the nature of the surface, the scattering properties of the atmosphere, and the incident zenith angle of solar radiation. The reflectivity of surfaces is a complex phenomenon. The simplified summary of radiative energy

transfer in the atmosphere is schematically depicted in Figure 1.1. On the same figure, I have also indicated a radiative energy transfer process (a small tree) that is absorbed by green plants where non-radiative energy transfer combined with electron transfer leads to photosynthesis. I have devoted a number of years of my academic life to understanding on a quantum level the processes involved in photosynthesis.

For specular surfaces like snow, ice, and water, the reflectivity will be close to zero at all angles except at the appropriately reflected angle. Thus, the albedo of snow surfaces may vary from 80% to 95%. In the case of diffusive surfaces, like for example a forest, the incident radiation is reflected in all angles equally, and its albedo diminishes to about 20% or less. However, nothing can match the albedo of clouds, which is quite high, and depending upon the type of clouds may reach 70%. The clouds, at any instance of time, on average cover about half of Earth's surface. According to various estimations, it is said that the Earth's albedo is about 30%. That is approximately the energy budget of our Earth. The importance of the polar regions in global meteorology is nicely illustrated by the fact that the albedo of surfaces covered by snow is about 10 times the albedo of the surface of dry sand.[30]

Regardless of how big Earth's albedo is, its variability – driven by intricate relationships between the energy from the sun, processes presented on Fig. 1.1, and Coriolis forces – is a predominant factor governing the global air circulation. Before introducing Earth's rotation into the examination of global air circulation, let us look at the meridional (North and South) circulation of a motionless planet.

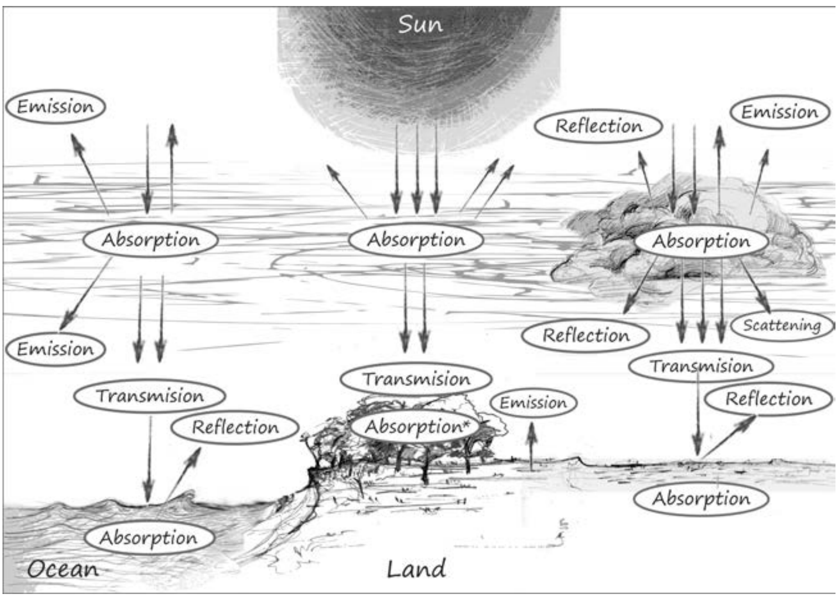


Figure 1.1. The simplified summary of radiative energy transfer in the atmosphere.

Because the mean distance between Earth and the sun is about 1.5×10^8 km (150 million kilometers), it is fair to assume that Earth's surface is uniformly exposed to incoming energy. Additionally, being at such a great distance from the Sun and hav-

ing a diameter only a tiny fraction of the Sun's, one may conclude that Earth captures an extraordinarily small amount of the Sun's energy, about 2×10^{-9} Joules. However, because Earth's surface is roughly spherical, the amount of energy received per unit area will be greater at the equator and will diminish towards the North and/or South Poles.

Therefore, the accumulated amount of energy at low latitudes will be higher than at the poles. Warm air will rise more effectively at the equator than at the poles, leading to an air pressure difference. Air, like any fluid, tends to move from high to low pressure, and thus the upper atmosphere would be set in motion from the equator polewards. This motion raises the sea-level pressure near the poles and reduces it near the equator. As a result, the surface air would move from poles toward the equator.

Such inequality in heat exposure between latitudes produces south winds above and north winds below at the northern hemisphere of a non-rotating planet. Obviously, the reverse takes place at the southern hemisphere, as depicted on Fig. 1.2. According to the model of Fig. 1.2, one should expect to have a prevailing northerly near surface wind in the northern hemisphere, and a prevailing southerly surface wind in the southern hemisphere. At the same time, one should observe no surface winds at the equator and at either pole.

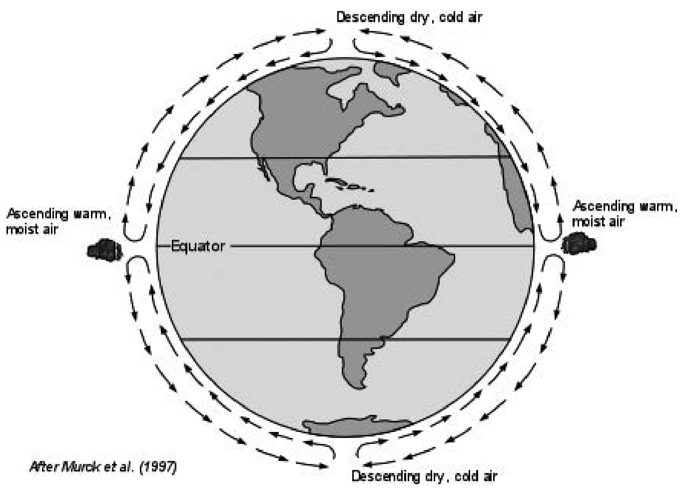


Figure 1.2. Scheme of one-cell global air circulation patterns.

The described behavior of atmospheric models of air circulation between predominant heat a sources at low latitudes and cold sinks at high latitudes have been observed (with few minor modifications) for a non-rotating Earth. However, this model is entirely incorrect. It does not take into account the fact that air cooled in the upper atmosphere would tend to drop at distances shorter than the equator-pole distance. Moreover, what would happen to models of air circulation if a planet's (Earth's) rotation is added?

While analyzing the causes of general trade winds, George Hadley (1685–1768) pointed out[31] that not only the sun and its radiation, but also the share of the diurnal motion of the Earth, are responsible for their directions. At the end of his short memoir, he summarized his observations by formulating two theses. In the second, he observed

> That the NE and SE winds within the tropics must be compensated by as much NW and SW in other parts, and generally all winds from any one quarter must be compensated by a contrary wind somewhere or other; otherwise some change must be produced in the motion of the earth round its axis.

From our modern perspective and knowledge, Hadley's notions are verbal formulations based on the conservation of linear momentum[32] to explain the trades.

During the early stages of meteorology, more than one hundred years passed with no particular developments and/or discoveries, as it was the Dark Age of this discipline and the Age of Enlightenment was still to come. However, this all changed when the brilliant Gaspard Gustave de Coriolis (1792–1843), at the pinnacle of scientific thinking,[33] noticed in 1831 that in order to present an "equation of the relative motion of a system of bodies or of any machine," it is sufficient "to add to the existing forces two kinds of supplementary forces."[34] In modern usage, these supplementary forces are termed fictitious forces (*non-existent*) and are apparent forces that act on masses in a non-inertial frame of reference.

To study Coriolis forces, one has to specify frames of reference, inertial and non-inertial. The inertial frame of reference can be affixed to Earth's axis of rotation, which maintains a nearly steady bearing on a point on the celestial sphere that is close to the North Pole Star, currently Polaris with an angular velocity $\omega = 7.2921 \times 10^{-5}$ $\text{rad} \cdot \text{sec}^{-1}$ or 23 hrs, 56 min and 4.09 sec, for one rotation of the Earth.[35] The non-inertial frame of reference can be affixed to any mass on Earth's surface.[36]

The actual understanding of the Coriolis effect rests on understanding the idea of the frame of reference, or better to say, an observational reference frame: inertial and non-inertial. A good deal of physics is based on examination of physical processes observed from different inertial spatial frames (Galilean transformation) and spatiotemporal frames (Lorentz transformations). In the case of non-inertial reference frames or accelerated frames in less formal language, one has to deal with fictitious forces like centrifugal, reactive centrifugal, Coriolis, and Euler.[37] Therefore, the Coriolis force is a fictitious force observed by a rotating observer from his non-inertial (rotating) frame of reference.[38]

Buys Ballot's law (1857) claims that for an observer in the Northern Hemisphere who stands with his back to the wind, the low-pressure area will be on the observer's left as a direct result of the Coriolis lateral accelerations.

Albert Einstein, in a short article,[39] tackled more fundamental physical questions related to relativity theory and the inertia of a body expressed by Mach's principle to counter Newton's bucket argument explaining the causes of the formation of meanders in the courses of river – Baer's law. The centrifugal force produced by the rotation was analyzed and an explanation of Baer's law was proposed in terms of Coriolis accelerations. However, one should remark that these forces are extremely small and hardly observable at river banks.

Nowadays, many simple assumptions introduced to derive the above equations have been replaced by much more advanced equations, formulated and numerically solved to predict, for example, satellite trajectories, or account for Earth's rotation, or the phase of the neutron quantum mechanical wave function.[40]

It is widely accepted in meteorological literature that two American scientists, William Ferrel[41], and James H. Coffin[42] developed at approximately the same time theories which explained the mid-latitude atmospheric circulation in considerable

detail. Their views are generally accepted even today and one of their air circulation cells is called a Ferrel cell, as apparently he was the first to formulate this theory. (see Fig. 1.3) To our knowledge, there was one more American researcher who was at equal terms in developing a similar theory. He was F. M. Maury, who at about the same time published two books[43], corresponding to Ferrel and Coffin's work, but with less precision in presentation and discussion of air cells.

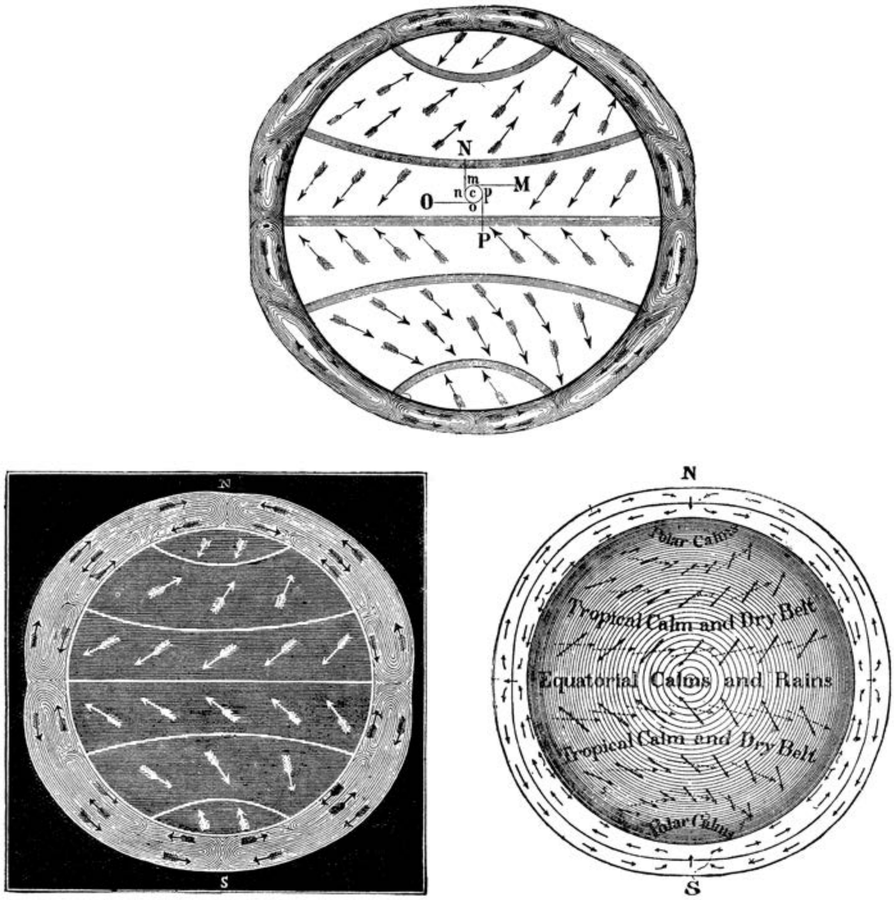


Figure 1.3. William Ferrel's three-cell global air circulation patterns. The depicted figures "are of historic interest, and are given to show, by comparison with this, how Ferrel changed his ideas in the course of thirty years' study"[1]

[1] Frank Waldo, *Modern Meteorology: An Outline of The Growth and Present Condition of Some of its Phases*, Walter Scott, London, 1893, *cf.* p. 301–303.

Ferrel, in his *Essay on the Winds* in the paragraph *The forces concerned in producing the motions of the atmosphere*, names four principal forces which control winds on Earth. The *primum mobile* of the winds is arising from the Sun's radiation generating a temperature dependent on the specific gravity of air and its movement. A second force arises from the tendency which the atmosphere has, when it has risen above the

general level, to flow to places at a lower level. The mentioned forces act as countercurrents in modes described by Hadley. To account for the next force, Ferrel observed that the combination of air movement toward the north or south with the rotatory motion of the Earth produces a third force, which causes a deflection of air motion. In here, he relies on the work of Pierre-Simon Laplace concerning solutions to so-called tidal equations (1776).[44] Ferrel cites an equation, which I reproduce here exactly as in the original paper

$$2\ n\ u\ r\ sin.l\ cos.L;$$

where l being the latitude; n, the motion of the earth at the equator; u, the velocity of the particle north or south; and r, the radius of the earth. Now, we can recast this equation using modern notation and obtain[45]

$$2rv_h v_r \sin\varphi\cos\varphi = 2\omega_h v_r \sin\varphi = 2\boldsymbol{\omega}_h \times \boldsymbol{v}_r$$

precisely the true horizontal Coriolis acceleration of $\mathbf{a}_{\mathrm{Ch}}$. Thus, the third force considered by Ferrel was the original Coriolis force. The lack of a minus sign in the above equation is not important, as the direction of a vector depends on its relative definition.

The last force considered by Ferrel is the combination of a relative east or west motion of the atmosphere with the rotatory motion of the earth. In a similar way as above, Ferrel again used the Laplace tidal equation *2 n v r sin.l*; *v* being the relative eastern or western velocity of the atmosphere. From Ferrel's description of this force, it seems that he understood its very nature and the missing *cos.l* in the just mentioned equation is a typo.

Thus, Ferrel's equation in the original notation for the fourth force is 2 *n v r sin.l cos.l* which in modern notation takes the familiar form

$$2\omega_r v_r \cos\varphi = 2\boldsymbol{\omega}_r \times \boldsymbol{v}_r$$

which is exactly the radial $\boldsymbol{a}_{\mathrm{Cr}}$ Coriolis acceleration.

It should also be noted that several years before Ferrel's work, and right after Coriolis' contribution, the famous French mathematician Siméon Denis Poisson discussed in 1837 that the effect of the earth's rotation is to cause it to deviate to the right of its path in the northern hemisphere, and to the left in the southern.

It is clear from the above presentation that William Ferrel's description of atmospheric air circulation was the most comprehensive one and properly accounted for the fictitious forces described by Gaspard Gustave de Coriolis in 1831.

Now it is time to formulate Ferrel's theory using a modern approach and terminology. Figure 1.4 presents a summary of general atmospheric air circulation on Earth. On this figure, three "cells" of Earth's atmosphere have been identified, and two of them are named after Hadley and Ferrel.

The Hadley cell general mechanism is well understood, and is responsible for the direction of the *trade winds* which propelled Christopher Columbus' vessels in his quest to Asia. The air over the tropics, especially near the equator, is heated by contact with the earth. Therefore, it rises. The air rising from the bottom of the atmosphere is replaced by winds blowing from higher latitudes. If the Earth did not rotate, these winds would blow directly from the north. However, the Earth is rotating, and its rotation from the frame of reference associated with atmospheric

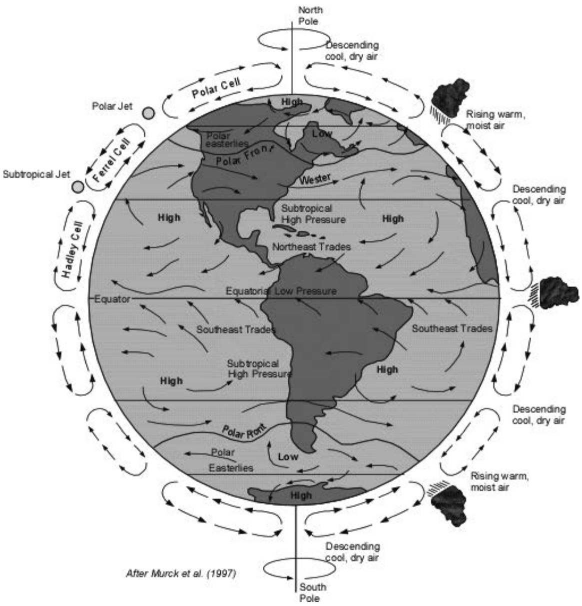


Figure 1.4. Modern three-cell global air circulation patterns.[1]

[1] http://en.wikipedia.org/wiki/Atmospheric_circulation

air would deflect the wind vector toward the west. The resultant wind vector will have a North-East direction. Wind direction is understood as the direction from which it originates.

In between the edges of the Hadley and Polar Cells, the second air cell, called the Ferrel Cell, is present with ascending air currents at 60°N and 60°S, and descending air at 30°N and 30°S. These air currents, combined with the Coriolis force, give a rise to the *prevailing westerlies* winds. Between (30° – 60°)N and (30° – 60°)S, the air at the surface (ocean or land) tends to flow away from the equator, from a semi-permanent 30° high-pressure belt towards the semi-permanent 60° low-pressure belt.

The Polar Cell, which is thinner and smaller than the Hadley Cell, is cantered at both poles. Between 60°N and the North Pole, and also between 60°S and the South Pole, the near surface atmospheric air tends to flow away from the poles and towards the equator. Air flowing away from the poles is subject to the Coriolis force. Air deflected towards the east gives rise to dry and cold winds called the *polar easterlies*.

The briefly described air cells above are also categorized in terms of geographical zones and differentiated by their climate and the behavior of the Sun. These zones are directly related with described air cells above and are named:

- The North *Frigid Zone*, north of the Arctic Circle
- The North *Temperate Zone*, between the Arctic Circle and the Tropic of Cancer
- The *Torrid Zone*, between the Tropical Circles
- The South *Temperate Zone*, between the Tropic of Capricorn and the Antarctic Circle
- The South *Frigid Zone*, south of the Antarctic Circle

Ferrel's original 1856 paper was published in the rather obscure Nashville Journal of Medicine and Surgery. For the next 30 years, Ferrel was developing his original global air circulation thesis. His struggle with the question is well illustrated by two figures produced by Ferrel, in addition to the one depicted above in Fig. 1.1.

Although William Ferrel is widely acknowledged as the first scholar who properly related earth rotation and global air circulation, I have found during my research on this issue that there was another American fellow named Charles Tracy, who in 1843 successfully approached the question.[46] Tracy was quite straightforward about the issue[47]

> The velocity of the earth's surface in the daily revolution being at the equator more than one thousand miles an hour, in latitude 60° half as much, at the pole nothing, and varying in intermediate places as their perpendicular distances from the earth's axis and the atmosphere near the ground everywhere taking in part or wholly the motion of the surface it rests on, important consequences upon aërial currents must follow. A body of air set in motion from the equator northward maintains the equatorial eastward velocity, and when it passes over regions of slower rotation deviates eastward from the meridian, and ultimately describes over the earth's surface a curved line bearing towards the east.

Tracy, when summarizing his analysis, arrived at the conclusion that "In the southern hemisphere the same law of deflection produces contrary results. There the wind which first moves north bends to the west, and the wind which moves south at first turns towards the east, that from the east turns south, and that from the west turns north."[48] To support his observations, the author produced the respective graphics, similar to these reproduced here in Fig. 1.3.[49]

At first glance, by comparing Tracy's figure with the respective Ferrel figures, one can notice that the directions of air flows on the Tracy figure (and description) are the opposite to Ferrel's whose analysis was right. This particular case shows the very nature of scientific speculations. It shows how two independent (or dependent) scholars may at about the same time analyze the same problem, but arrive at opposing conclusions.

It is an intriguing puzzle why Charles Tracy's descriptions are right but contrary to the expected one. I will not clear this "mystery" here, and leave it for the reader to investigative. To hint at a possible solution, I will add the final lines from Tracy's article:

> Water discharging from a broad basin through a central orifice is subject to the same law. It forms a vortex which in our hemisphere turns to the left, or against the sun, and in the southern hemisphere must turn to the right or contrary to the sun there. These rotations of the atmosphere and of water, being from west to east about lines inclined to parallelism with the earth's axis are singularly coincident in direction with the rotation of the globe, and harmonize with the general mechanism of the heavens.

The fact that at about the same time, four Americans, Charles Tracy (1843), William Ferrel (1856/1859), Matthew F. Maury (1859), and James H. Coffin (1875) independently arrived at a similar description of global air circulation may be called an American Surprise.[50] However, one would be even more surprised to learn that the American explorer Charles Wilkes, who sailed into the Antarctic Ocean, also pub-

lished a book in which he correctly accounted for global circulation. Captain Wilkes in his book *Theory of the Wind*, published in 1856, explained[51]

> It is known that the earth revolves on its axis, in a direction from west to east, increasing from the Poles to the Equator, where it attains a velocity of 1000 miles per hour, – so that the air, in passing from the highest latitudes towards the Equator, progressively arrives at regions of increased rotary velocity; and, as they cannot keep pace with this increase of motion, they necessarily hang back, and form currents flowing in a direction opposite to that of the rotation of the earth, or from east to west, and thus, by these combined efforts, the northern and southern currents of air are deflected and modified, so as to become the permanent north-easterly and south-easterly currents, forming the magnificent phenomenon of the Trade Winds.
>
> The theory is summed up, that whenever the air has greater velocity of rotation than the surface of the earth, a wind more or less westerly is produced, and when it has less velocity, a wind having an easterly tendency results.

It was Archimedes[52] who proclaimed "Eureka!" when he stepped into a bath and noticed that the water level rose. Apparently excited by this realization, Archimedes jumped out of the bathtub and ran through the streets of Syracuse naked. After the initial excitement waned, he probably returned and drained the already cold water from the bathtub. We do not know for certain, but it is possible that Archimedes' curiosity allowed him to observe another miracle; the bathtub vortex, a prototype of all vortexes.[53]

Determination of the bathtub vortex's direction of rotation has been the focus of intense fascination for many years. In general, the vortex is a local phenomenon in the fluid flow. However, after its formation, the vortexes may be "the sinews and muscles of the fluid motion"[54] and "the sinews of turbulence".[55]

To my knowledge, Tracy's reference to the bathtub vortex is the first description of this phenomenon in writing. Since Otto Tumlirz's first experiments in 1908[56], there have been a large number of experimental and theoretical analyses of vortices. In accordance with theoretical predictions, experiments have confirmed that vortices tend to rotate counter-clockwise in the northern hemisphere[57] and clockwise in the southern hemisphere[58] and at the South Pole.[59] If the earth was exactly spherical and the measurement was taken exactly at the rotation axis with the size of the water container and orifice being sufficiently small, then one would not observe a vortex. Apparently, the reported measurement at the South Pole was not taken under these idealized conditions.

The theory of rotational flow in an ideal fluid was formulated in 1858 by German polymath Hermann von Helmholtz, who had also made important contributions not only in physics, but also in meteorology, physiology, and psychology.[60] Between 1858 and 1890, Helmholtz published five papers related to atmospheric motions. In the paper "On the integrals of the hydrodynamic equations that represent vortex motions" published in 1858, he formulated three theorems for a fluid that is assumed to have no viscosity:

- No particle of liquid acquires rotation that was not in rotation from the beginning.

- The particles of liquid that at any moment belong to the same vortex line remain in the same vortex line, even although they have a motion of translation.
- The product of the sectional area by the velocity of rotation of an infinitely slender vortex filament is constant along the whole length of the filament, and also retains the same value during the translator motion of the filament. Therefore, the vortex filaments must return into themselves within the liquid, or can only have their ends at the boundaries of the fluid.

The careful reader may object that Helmholtz was analyzing highly unrealistic cases of non-viscous fluids (inviscid flow – frictionless) and the movement of rigid bodies in such fluids. Under these non-viscous conditions, explanation of the famed d'Alembert's paradox – the drag force is zero on a body moving with constant velocity relative to the fluid – was impossible. The main difficulty with adding, for example, for example friction to the Helmholtz equations and analyzing is related to the fact that such additions lead to nonlinear equations. In general, nonlinear equations are hard to solve analytically, and one has to resort to numerical methods, which of course were not available at that time. Even until the beginning of the twentieth century, with increasing interest in aerodynamics, many issues related to Helmholtz's work remained unclear. The difficult situation was figuratively described by Sir Cyril Hinshelwood "… fluid dynamicists were divided into hydraulic engineers who observed what could not be explained, and mathematicians who explained things that could not be observed."[61] Not only hydraulic engineers, but also meteorologists observed what could not be rationalized.

The above comments are sufficient for our further analysis, and I will not continue on the development of theories related to fluid dynamics. Finally, I wish to bring to the attention of the reader the importance of friction in analyses is of vortex motion. This well-known example belongs to Albert Einstein's analysis of Baer's Law. Einstein used tea leaves in a cup to illustrate his point[62]

> Imagine a flat-bottomed cup full of tea. At the bottom there are some tea leaves, which stay there because they are rather heavier than the liquid they have displaced. If the liquid is made to rotate by a spoon, the leaves will soon collect in the center of the bottom of the cup. The explanation of the phenomenon is as follows: the rotation of the liquid causes a centrifugal force to act on it. This in itself would give rise to no change in the flow of the liquid if the latter rotated like a solid body. But in the neighborhood of the walls of the cup, the liquid is restrained by friction, so that the angular velocity with which it rotates is less there than in other places nearer the center. In particular, the angular velocity of rotation, and therefore the centrifugal force, will be smaller near the bottom than higher up. The result of this will be a circular movement of the liquid of the type illustrated in Fig. 1 which goes on increasing until, under the influence of ground friction, it becomes stationary. The tea leaves are swept into the center by the circular movement and act as proof of its existence.

It is clear from Einstein's analysis that without introducing friction, it is impossible to explain a tea leaf's movement in a cup. In exactly the same way, the analysis of atmospheric air circulation without taking into account of friction between air and

surface (land, water or ice) would not give correct results. While trying to account for friction, Helmholtz faced a very serious mathematical difficulty. In order to formulate a mathematical model of atmospheric air circulation, Helmholtz used differential equations, which describe evolution (in time) of the system. However, these equations would be not of much use if one cannot not specify two conditions: (1) the initial condition and (2) the boundary conditions. Every student of mathematics – and especially physics – knows the importance of initial and boundary conditions.

Because differential equations describe the evolution of the system in time, one has to specify this evolution by setting *the initial conditions*. From these initial variables (the initial conditions), the system will evolve in time in a desired (expected) direction.

I have already pointed out the sensitivity of differential equations upon the initial conditions in reference to the simple set of differential equations analyzed by Lorenz. These equations were a simple version of more general equations called Navier-Stokes equations, which forcefully depend on the initial conditions, and steps of integration. Therefore, one should be aware that great precision of calculating temperatures, wind velocity, *etc*. cannot be expected.[63] The award of 1 million USD awaits the person who can prove the solution or provide a counter-example of the solution to a three-dimensional Navier-Stokes equation. The Clay Mathematics Institute has called this difficulty one of the seven most important open problems in mathematics.[64] Usually, the 'solvability' or 'integrability' of the model is connected with the existence of special symmetry. In many cases, the presence of the symmetry enables one to simplify the analysis of the corresponding problems.[65] In some cases, Norwegian mathematician Sophus Lie's algebra even further simplifies the equations under consideration.

In addition to the initial conditions, one has to determine a set of conditions specified for the behavior of a set of differential equations at the boundary of its domain. Thinking about atmospheric air friction as a function of distance from the Earth's surface, one must set a *finite* friction coefficient at the earth-air boundary and a *zero* friction coefficient at an infinite distance from the Earth's surface.

In order to solve (I should rather say try to solve) his differential equations, Helmholtz specified both the initial and boundary conditions. Provided that Helmholtz analyzed a well-posed problem,[66] he would find a solution for viscous air. However, he could not overcome the difficulties in manipulating differential equations to get their solutions. Helmholtz would not have been a genuine scholar if he gave up. Instead, to solve the respective equations, he successfully investigated frictionless solutions.

About fifty years after Helmholtz's work, his fellow countryman Ludwig Prandtl[67] discovered an approximate and effective method to solve differential equations describing fluid motions *with* friction. The approximation was called the boundary layer approximation. By making this approximation, the flow is divided into an inviscid portion (which is easy to solve by a number of methods as shown by Helmholtz), and the boundary layer, which is governed by the respective differential equations which are more tractable and easier to solve. The boundary layer approximation is one of the most important advances in fluid dynamics.

> In the atmospheric context, it has never been easy to define precisely what the boundary layer is. Nevertheless, a useful working definition identifies the

> boundary layer as the layer of air directly above the Earth's surface in which the effects of the surface (friction, heating and cooling) are felt directly on time scales less than one day, and in which significant fluxes of momentum, heat or matter are carried by turbulent motions on scale on the order on the depth of the boundary layer or less.[68]

1.2. Importance of Polar Meteorology

The rôle of the glacial anticyclone in the air circulation of the Globe.

William H. Hobbs[69]

Spiral galaxies, neutron stars, atmospheric or oceanic circulations, bathtub vortices, and even whispering vortices in the galleries of St. Paul's Cathedral in London[70] are examples of vortices at all scales. We have already seen that the Earth's rotation is a preliminary factor in which fictitious Coriolis forces control the atmospheric air circulation. Towards the end of the nineteenth century, Coriolis' original discovery was becoming widely accepted in physics, and slowly (but as I will show later not always successfully) percolated into general meteorology. Throughout history, there was always a considerable lag between developments in physics and their application in meteorology.

At the beginning of the nineteen century, it was commonly believed that the atmospheric pressure at sea level was in all parts of Earth about the same. Over time, however, more and more meteorological observations were taken. One of the most influential observations, which helped William Ferrel (and possibly Charles Tracy) to formulate their theses, were observations reported by the Antarctic explorer Charles Wilkes

> The most remarkable phenomenon which our observations have shown is the irregular outline of the atmosphere surrounding the earth as indicated by the pressure upon the measured column at different parts of the surface. Our barometrical observations show a depression within the tropics, a bulging in the temperate zone, again undergoing a depression on advancing towards the Arctic and Antarctic circles.

Similar observations were also made by James Ross who, in search of the south magnetic pole, found a true gateway into the continent, McMurdo Sound. Ross reported[71]

> Our barometrical experiments appear to prove that the atmospheric pressure is considerably less at the equator than near the tropics; and to the south of the tropic of Capricorn, where it is greatest, a gradual diminution occurs as the latitude is increased.

Expedition after expedition to the Arctic returned with more and more scientific data. Exemplary work during geographical exploration – scientific data collection and analysis – was done by Fridtjof Nansen and his team during the *Fram Expedition*,

1893–1896. Nansen was a man of dazzling intellectual range and energy. He emerged from the northern mists[72] together with other Norwegians like Nils Henrik Abel (group theory), Sophus Lie (Lie algebra), the Bjerknes clan, Henrik Ibsen, Edvard Greig, and of course Roald Amundsen, to name just a few.

The *Fram Expedition*'s results, under the title *The Norwegian North Polar Expedition 1893–1896 Scientific Results*, were published in a series of green-coated volumes. The volumes were published at the expense of the "Fridtjof Nansen Fund for the Advancement of Science" foundation, which derived its capital from Nansen's lectures in Europe and America. Volume VI, with almost 700 pages, is devoted to meteorology.[73] The observations were done by Captain Sigurd Scott-Hansen and his assistants, Capt. Hjalmar Johansen and Bernard Nordahl. Although the volumes were edited by Fridtjof Nansen, this particular meteorological tome was prepared for publication and annotated by the Norwegian meteorologist Professor Henrik Mohn. Some of the results were surprising. The average wind velocity measurements over a three-year period, when *Fram* drifted frozen in sea ice, was calculated at about 4.5 m/s, which is indeed a very moderate/low value. In the Beaufort scale, it is equivalent to a *gentle breeze*, Beaufort number 3.

One of the objectives of Nansen's meteorological measurements during the *Fram Expedition* was to find whether the winds over the Arctic were cyclonic or anti-cyclonic in nature. This interest resulted from the aforementioned Bjerknes and his school research. However[74]

> Professor Mohn states that the great distance between the *Fram* and any permanent or temporary meteorological station made it quite impossible to construct daily synoptic weather charts by means of which to study the influence of moving cyclonic and anti-cyclonic systems. He has however utilized the observations on the *Fram* in the light of our knowledge of the laws of cyclonic motion taking account of the coefficient of friction deduced from European observations and has tabulated the resulting computed bearings of the centers of low pressure and their motions. During three years the *Fram* came within the sphere of influence of at least as many as 73 moving areas of low pressure.

In the above-mentioned calculations, Dr Mohn, in order to account for deflection, used the correct Coriolis coefficient.[75] In an attempt to briefly summarize Nansen's meteorological observations, Mohn concluded[76]

> In the circumpolar arctic sea, calms are relatively rare, cyclonic movements are frequent, the upper and lower layers of air are mingled together, and the cooling down of the surface of the earth or of the polar ice is checked by the circumstance that the underlying water has a temperature of only –1.6°.

But it was not only on this occasion that the power of the omnipotent fictitious Coriolis force was appreciated by Norwegians, whose keen relationship with nature led to an important and lasting discovery. Namely, "On studying the observations of wind and ice-drift taken during the drift of the *Fram*, Fridtjof Nansen found that the drift produced by a given wind did not, according to the general opinion, follow the wind's direction but deviated 20°–40° to the right."[77] Nansen empirically recognized the possibility of rotation of the current vector as a function of depth, and suggested

to Bjerknes that it should be examined more formally. Bjerknes assigned the problem to a young mathematician and physicist, V. Walfrid Ekman, who solved it and thereby his name was given to the phenomenon known as the Ekman Spiral.[78]

Although the knowledge of Arctic meteorology at the turn of the twentieth century was far from satisfactory, one could observe a steady increase of new weather stations around this region. In most of the cases, land stations in northern Canada, Greenland, northern Europe, a few in Siberia, and Alaska provided insight into the meteorology of North Polar regions. In general terms, the Arctic weather is driven by the relationship between the sea, sea-ice, and land masses surrounding the Arctic. The Northern Hemisphere polar region is basically an ice-covered ocean encircled by the Eurasian/American continents. In the summer, but especially during the winter, significant heat conduction occurs through leads, polynyas, and the relatively thin ice cover of the Arctic Ocean. The coldest areas are therefore located in the center of the Eurasian landmass, far away from the North Pole. Consequently, the ice-covered Arctic Ocean acts to reduce the wintertime cooling.

One could not say so about the southern hemisphere, where the remote Antarctica was a difficult place to access. The travels of James Cook, Fabian von Bellingshausen, Charles Wilkes, James Ross, and others provided evidence that Antarctica must be a very cold place.

Adrien Gomery de Gerlache[79], a young Belgian naval lieutenant, assembled a truly international team in 1897 and sailed down to the eastern side of the Antarctic Peninsula. De Gerlache's team was remarkable and included two future explorers of polar regions: Captain Amundsen as a first mate and Frederick Cook as a ship's doctor. During the expedition, two Polish scientists, Henryk Arctowski[80] (geologist, oceanographer, and meteorologist) and his assistant Antoni Bolesław Dobrowolski[81] (assistant-meteorologist) made the *first* continuous daily meteorological recordings and measurements in Antarctica[82], every hour, for a whole year, while the expedition ship was unwillingly beset in the ice on Mar. 2nd, 1898. They also reported on oceanic currents and terrestrial magnetism. Careful analysis of the collected data led Arctowski to the remarkable conclusion and discovery of anticyclones in Antarctica. Arctowski remarked that

> From March 1st, 1898 to March 2nd, 1899, 70 such oscillations of pressure occurred, the mean amounts of their rises and falls of pressure being 15.9 and 16.0 mm, respectively. The duration of these rises and falls lasted on the average 63 hours in each case. Thus the mean duration of one oscillation was 5 days 6 hours.

One should not confuse anticyclone[83] with the *El Niño-Southern Oscillation*, which is a different phenomenon. Arctowski and Dobrowolski's observations were important for the general scientific interest in circulation of the atmosphere,[84] and particularly for verification of William Ferrel's[85] hypothesis that "these must be [the poles] regions in which these is very nearly a calm, unless these is some abnormal disturbance."[86] Ferrel's theoretical model of air circulation did not take into account the "… abnormal disturbance" of the vast dome of the Antarctic ice cap, and it quickly became evident from Hobbes' analysis that the snow-ice mass is a driving force of atmospheric processes, and "If Ferrel's theory were correct, Antarctica would be a land of rain and fog instead of what it is known."[87]

The demand for more meteorological data was obvious, and Arctowski observed[88]

> But not withstanding all the importance of the results obtained by the *Belgica*, *Southern Cross*, *Gauss*, *Discovery*, *Antarctic*, and the *Scotia*, I consider the whole of these new acquisitions to science as being only a work of orientation – provisory work…The thing is to have as great a number of stations as possible working, all simultaneously, not only in view of accumulating the figures resulting from the ordinary hourly meteorological observations, but, first of all, in view of enriching our knowledge of the meteorological conditions of the upper regions of the atmosphere by experiments with self-registering instruments mounted on kites and by continuous study of the clouds, especially of their light and the direction and speed of their displacement.

Henryk Arctowski's quest to launch his own Antarctic expedition was effectively forestalled by Ernest Shackleton and his *Nimrod Expedition*, 1907–1909. For many, this expedition stands as the farthest south record short of the South Pole. However, it should be noted that the *Nimrod Expedition*'s results had shown: (i) a gateway to the South Pole *via* the Beardmore Glacier, (ii) the limit of the ratio distance/weight of British polar transport techniques (man-hauling supported by draught animals), and (iii) that the South Pole is located at an 11,000 ft high plateau, which according to Shackleton's estimation continued beyond the geographical South Pole, and extended from Cape Adare to the Pole.[89]

The discovery of the high plateau ice dome was unquestionably the most important discovery related to the development and understanding of Antarctica's air circulation. Its effect was well recognized by William Herbert Hobbs, unlike George C. Simpson.[90]

We have been waiting up until the mid-eighties of the last century, due to technological progress in meteorological data acquisition and satellite transmission, for automated weather stations to be installed in Antarctica. In the latter part of this book, while analyzing Captain Scott's meteorological data, I will use the respective data measured by automated weather stations installed at the Ross Ice Shelf.

The present understanding and knowledge of air circulation over the Antarctic continent in some minor points differs from its state at the beginning of the twentieth century. The differences are indeed negligible and essential only for specialists in the field. However, because I am concerned with major issues related to atmospheric air circulation in Antarctica, I can describe the work of the main contributors in this area of meteorology. The researchers who significantly contributed were William Herbert Hobbs (1864–1952), Wilhelm Meinardus[91] (1867–1952), William J. S. Lockyer (1868–?)[92], Sir William Napier Shaw (1854–1945) and George C. Simpson (1878–1965).

Each of these scholars came to the subject from different backgrounds and perspectives. Hobbs was an American geologist, who published in 1911 a book entitled *Characteristics of Existing Glaciers*, which still holds its scholarly value. Wilhelm Meinardus was a German geographer who published on 'Klimakunde der Antarktis' and participated in the Deutsche Südpolar-Expedition, 1901–1903 (*Gauss Expedition*)[93]. William Lockyer was a British meteorologist and son of Sir Norman Lockyer, a British astronomer and founder of the general science journal *Nature* in 1869. Sir William was a director of the British Meteorological Office from 1905 to 1920. He was succeeded by Dr George Simpson.

Although the theoretical analysis and description of polar air circulation was quite advanced, the state of knowledge of Antarctic meteorology resulting from actual measurements at the beginning of the last century is best described in the so-called *Antarctic Manual* prepared for the then Commander Scott's *Discovery Expedition*[94]

> The meteorology of the Antarctic regions is practically unknown to science, inasmuch as only one expedition, that of the Belgian Government, in 1898–9, has been able to furnish observations for even one complete year.

Within about twenty-five years, which marked *The Heroic Age of Antarctic Exploration* (1897–1922), a large but scattered body of meteorological data was gathered by all expeditions.

From our meteorological point of view, however, the most important contribution of this exploration came as I have already mentioned, from Shackleton's discovery of the Antarctic polar plateau. Of course, this geographical discovery was later strengthened by Captain Scott, Captain Amundsen, and all remaining expeditions which probed the Antarctic continent's coastal fringes.

It happens in scientific research quite frequently that seemingly unimportant findings lead to great discoveries. At the beginning of the twentieth century, for many physicists, the most of the important work and discoveries has been already been done and only two minor issues remained unaddressed: black body radiation and the question of ether. These two issues led to the development of quantum mechanics and the theory of relativity.

In our case, the question which accompanies Lt Shackleton's geographical discovery is indeed simple and provoking: where did this Antarctic snow/ice plateau come from? Or, how does the snow/ice dome maintain its volume once it is formed?

To answer this question, I will follow one of the most effective methods in science: that is, I will look at this question from the conservation law point of view. The conservation law states that certain measurable physical quantities do not change in time. Or more simply, certain quantities are conserved. Although the conservation law is *via* Noether's Theorem directly connected to symmetries of physical systems, one should note that massless, chargeless particles called neutrinos invented to ensure conservation laws at the atomic scale are always left-handed. By chance, the Antarctic snow/ice dome plays an important role in physicists' search for neutrino particles. The *IceCube* Neutrino Observatory was built in proximity to the Amundsen-Scott South Pole station. The *IceCube* neutrino detectors are buried in an ice/snow layer at about 2000 meters below the surface.[95]

Let us return to the description of global air circulation by Ferrel, and in particular to air circulation within the Polar Cell, as depicted on Figure 1.4. One can notice that the cold air within the Polar Cell will descend at the South Pole region. This relatively dry and cold air is blown outward from the pole in all directions. Due to the Earth's rotation and the Coriolis force, the Polar Cell creates at the South Pole a large-scale circulation of winds of high atmospheric pressure around the South Pole region. And because its movement is counter-clockwise, this circulation is called *anticyclone*. The general concept of cyclone and anticyclone was presented in 1863 by Francis Galton, in a two-page note published in the Proceedings of the Royal Society of London.[96] He also introduced the concept of a correlation between statistical data[97] and regression

towards the mean.[98] Because I will use these statistical ideas later, I mention Galton's contributions at this point.

Now if the interior of Antarctica is covered with snow and ice, and there is a discharge (ice calving) of the same to the marginal oceans, it follows that over Antarctica as a whole the precipitation exceeds the evaporation. Marginal ice discharge could occur only in such a region. It further follows that the excess of precipitation over evaporation must be furnished by air currents moving towards the interior of Antarctica. The hydro-economics of Antarctica must be somewhat as follows: the marginally discharging ice is exporting water from the south polar regions. This water loss must be compensated by an excess of precipitation over evaporation, and the excess precipitation must be made possible by the corresponding supply of water vapor carried by winds into the interior.

However, because of anticyclonic air circulation in the interior of the Antarctic continent, the air becomes very dry. Moreover, even if the moisture is formed by for example solar radiation, it is removed from the area by an outward anticyclone. The inquisitive reader may speculate that if the near surface air temperature in Antarctica is most of the time below freezing, then the amount of water vapor in the air should be very small, if any at all. Obviously, this particular observation is spatiotemporally dependent.

Nowadays, researchers use satellite water vapor imagery to measure humidity. However, back at the beginning of the twentieth century, more basic methods were used. It is more convenient to think about relative humidity instead of absolute humidity. The relative humidity, which is used extensively in meteorology, is defined as the ratio of the actual amount of aqueous vapor in a measured volume of air to the amount which the volume would contain if the air were saturated. Thus, a relative humidity of, say, 75 means that a certain volume of air is holding in the form of vapor 75 grams or ounces of water, whereas it is theoretically capable of holding 100 grams or ounces.

A hygrometer is an instrument for determining the humidity of the atmosphere. Almost all materials exposed to the weather are affected by the humidity of the air, so that it is easy to form a rough estimate of whether the air is damp or dry. Many different materials, such as hair catgut, the awn or beard of the wild oat, or flannel, have been used in instruments to give an indication of the state of the atmosphere in this respect. But for the purposes of meteorology, there are three well-known forms of hygrometer: the hair-hygrometer, the indications of which depend upon the length of a hair or a bundle of hairs exposed to air of different states of moisture; the dew-point hygrometer, in which a polished surface is artificially cooled until a deposit of dew is produced and the dew-point determined; and the psychrometer, or wet and dry bulb hygrometer, in which the temperatures of a bulb covered with moistened muslin and of a dry bulb close to it are read, and the humidity determined by tables. The psychrometer was in almost universal use at meteorological stations, as it is the least dependent upon the skill of the observer.

The wet and dry bulb hygrometer was used during the *Discovery Expedition*. The analysis of the results of humidity measurements during the *Discovery Expedition* was reported by the President of the Royal Meteorological Society (1901/2) William H. Dines[99], in an article entitled *Notes on Open Air Temperature, Screen Temperature, and on Terrestrial Radiation*, published as Part I of the *Meteorology Report* of the expedition.[100] Dines observed[101]

> The general opinion of meteorologists seems to be that the tables by which the relative humidity is obtained from the wet and dry bulb readings are open to doubt at very low temperatures and very low values of the humidity and hence it hardly seems worthwhile calculating the values of the humidity from these readings.
>
> One cannot help feeling regret that the opportunity to revise the humidity tables at low temperatures could not have been utilised.

Some eleven years later, Dr George Simpson, the meteorologist of Captain Scott's *Terra Nova Expedition*, commented along similar lines[102]

> With the whole of the wet bulb readings taken on the Discovery Expedition unused I did not feel inclined to add to the accumulation. Also there was much more important work to be done in the Antarctic than revising the humidity tables, for this can be done in more accessible regions of the globe. I therefore decided to take no wet bulb readings.
>
> The use of the hair hygrometer at low temperatures has been studied by Professor Mohn and his students in Norway, and a hygrometer designed which is said to be reliable in use. In the short time available for preparation before the expedition sailed I had no opportunity to obtain and familiarize myself with this instrument. The consequence was I removed direct observations of the humidity of the atmosphere from my programme hoping that I should be able to devise some indirect method of observation when in the Antarctic. The opportunity for this however never arose, so humidity is not discussed in the present work.

Antarctica is perennially cold, yet with latitudinally strong gradients of temperature and moisture (i.e., humidity, cloud cover, precipitation) located near the continent's fringes. However, the interior of Antarctica, with an *average* height about of 1.6 km and altitudes of 3000–4000 m, is the highest continent.[103] Antarctica is a polar desert with extremely low, near zero *absolute* humidity.

In December 1903, Commander Robert F. Scott and his team descended from the Victoria Land Plateau toward McMurdo Sound *via* one of the glaciers leading to the sea. While descending, Commander Scott observed[104]

> At the end of the second lake, the valley turned towards the north-east … Quite suddenly these moraines ceased, and we stepped out onto a long stretch of undulating sand traversed by numerous small streams, which here and there opened out into small, shallow lakes quite free from ice.
>
> I was so fascinated by all these strange new sights that I strode forward without thought of hunger … We commanded an extensive view both up and down the valley, and yet, except about the rugged mountain summits, there was not a vestige of ice or snow to be seen; and as we ran the comparatively warm sand through our fingers and quenched our thirst at the stream, it seemed almost impossible that we could be within a hundred miles of the terrible conditions we had experienced on the summit … It is certainly a valley of the dead; even the great glacier which once pushed through it has withered away.

Table 1.1. Essential meteorological data of Heroic Age Expeditions.

Expedition	Leader	Duration	Location	Published Record/Date
Belgian Antarctic Expedition	Adrien de Gerlache	Mar 1st, 1898- Mar 13th, 1899	70°37′S 88°35′W	Reference[1], 1902
Southern Cross Expedition	Carsten Borchgrevink	Feb 18th, 1899 Jan 28th, 1900	71°18′S 170°10′E	Reference[2], 1903
Swedish Antarctic Expedition	Otto Nordenskjöld Carl Anton Larsen	Mar 1st, 1902 Oct 31st, 1903	64°30′S 56°56′W	Reference[3], 1910
Discovery Expedition	Robert F. Scott	Feb 9th, 1902 Feb 15th, 1904	77°51′S 166°45′E	Reference[4], 1908
Gauss Expedition	Erich von Drygalski	Feb 19th, 1902 Feb 18th, 1903	66°02′S 89°38′E	Reference[5], 1909
Scotia Expedition	William Speirs Bruce	Nov 2nd, 1902 Jan 6th, 1912	60°43′S 44°31′W	Reference[6], 1915
Première Expédition Charcot	Jean-Baptiste Charcot	Aug 31st, 1903 Mar 4th, 1905	65°04′S 64°02′W	Reference[7], 1906
Nimrod Expedition	Ernest Shackleton	Mar 2nd, 1908 Feb 28th, 1909	77°33′S 166°09′E	Reference[8], 1930
Seconde Expédition Charcot	Jean-Baptiste Charcot	Aug 15th, 1908 Jun 4th, 1910	64°45′S 63°30′W	Reference[9], 1915
Terra Nova Expedition	Robert F. Scott	Jan 1st, 1911 Aug 31st, 1912	77°39′S 166°24′E	Reference[10], 1922
Fram Expedition	Roald Amundsen	Apr 1st, 1911 Jan 29th, 1912	78°38′S 169°37′	Reference[11], 1912
Second German Antarctic Expedition	Wilhelm Filchner	May 4th, 1911 Nov 26th, 1912	68°40′S 33°20′W	Reference[12], 1921
Australasian Antarctic Expedition	Douglas Mawson	Jan 31st, 1912 Dec 15th, 1913	67°01′S 142°41′E	Reference[13], 1929

[1] H. Arctowski, *Résultat du Voyage du S. Y. Belgica en 1897–1898–1899, Météorologique*; par Henryk Arctowski, 1904 and A. Dobrowolski, *Résultats du Voyage du S.Y. Belgica en 1897–1898–1899: Sous le Commandement de A. de Gerlache de Gomery. Rapports Scientifiques Publiés aux Frais du Gouvernement Belge*, Sous la Direction de la Commission de la Belgica (1903)

[2] Carsten E. Borchgrevink, *Magnetic and Meteorological Observations made by the "Southern Cross" Antarctic Expedition, 1898–1900*, Royal Society of London, London, 1902.

[3] G. Bodman, *Meteorologische Ergebnisse der Schwedischen Südpolar-Expedition: Stündlich Beobachtungen bei Snow Hill Wiss. Ergebn. Südpolar-Expedition, 1901–1903*, Vol. II, Stockholm, 1910.

[4] National Antarctic Expedition, 1901–1904. Meteorology, Part I, Royal Society, 1908.

[5] Deutsche Südpolar-Expedition, 1901–1903. III. Band: Meteorologie I. Bande I. II. Reimer, Berlin, 1909.

[6] *Report on the Scientific Results of the Voyage of S.Y. "Scotia" During the Years 1902, 1903 and 1904, under the Leadership of William S. Bruce*, Vol. II., Physics. Part I., Meteorology, 1915.

[7] Expédition Antarctique Française (1903–1905), Commandee par le D[r] Jean Charcot Sciences Naturelles: Documents Scientifiques Paris Masson et C[ie] Éditeurs, 1906; J. J. Rey, Météorologie. Expedition Antarcica Francais 1903–5. Hydrographie, Physique de Globe, Paris, 1911.

[8] E. Kidson, *Meteorology. Reports Scientific Investigations of the British Antarctic Expedition 1907–09*, Melbourne, 1930.

[9] J. Rauch, *Observations Météorologiques: Expeditions Antarctica Francais 1908–1910, Sciences, Physiques Documents Sciences*, Paris, 1914.

[10] George C. Simpson, *British Antarctic Expedition 1910–1913: Meteorology*; Vol. I, *Discussion*, Vol. II. *Weather Maps and Pressure Curves* Thacker, Spink, & Co., Calcutta, 1919; Vol. III, *Tables*, Harrison and Sons, Ltd., London, 1923.

[11] B. J. Birkeland, *Remarks on the Meteorological Observations at Framheim*, in Roald Amundsen, *The South Pole: An Account of the Norwegian Antarctic Expedition in the „Fram," 1910–1912*, John Murray, London, 1912, Vol. II, *cf.* p. 372; H. Mohn, *Roald Amundsen's Antarctic Expedition. Scientific Results: Meteorology*, Videnskapsselskapet, 1915; Julio Bustos Navarrete, *A Meteorological Study of the Antarctic Region and the Atmospheric Circulation over the Extreme Southern Pacific Ocean*, Mon. Wea. Rev. **56**(1928)174–177; J. Hann, *H. Mohn: Meteurologie der Antarktischen Expedition von R. Amundsen*, Meteorologiche Zeitschritf **33**(1916)97–102.

[12] W. Brennecke, *Die Oceanographische Arbeiten der Deutschen Antarktischen Expedition 1911–12*, Archiv. Deutsch. Seewarte **39**(1921)118–129.

[13] C. T. Madigan, *Tabulated and Reduced Records of the Cape Dennison Station, Adélie Land, Australian Antarctic Expedition, 1911–1914*, Science Reports Series B., Vol. IV, Sydney, 1929.

The snow-free valleys discovered by Commander Scott are the world's most extreme deserts and are now called the McMurdo Dry Valleys. Until now, the explanation of the extraordinary dryness of this area has been the subject of many studies with far-reaching applications. "The Antarctic dry valleys are Earth's most Mars-like environment. The climate and the physical processes shaping the surface are similar to those on Mars. Therefore, the dry valleys are suitable for testing some of the hypotheses that planetary scientists have about the Martian surface, and they may also be used to test some of the techniques and equipment that may one day be used to study the surface of Mars."[105]

In Table 1.1, I present essential information related to several expeditions of the early *Heroic Age of Antarctic Exploration*. The collected meteorological data included near-surface measurements of temperatures, wind velocity and direction and pressure. Additionally, several of these expeditions (*Gauss*, *Discovery*, *Terra Nova*) also performed upper atmosphere measurements. These upper air temperature measurements were particularly important for understanding the air circulation of Antarctica.

I live in a house on the south oriented side of a small range (955 m above the mean sea level), which is facing a 7.5 km wide valley dotted with small hills. The valley runs west to east, thus runs parallel to my home. The valley on its south side is closed by the Tatra Mountains, with moderate height summits rising up to 2,500 m. Between October and May, we may experience Föhn winds (called *Halny* in local highlander dialect), which cause irritability and bad temper amongst the household. No official treatment is available, but homemade cordiality helps everyone.

More frequently, however, we observe another meteorological phenomenon called inversion – more precisely temperature inversion when the smoke from the

chimneys of the houses scattered across the valley goes to a certain vertical elevation, and stops almost as if there is an invisible glass barrier prohibiting it to rise. Smoke rising is prevented by an air layer, which is warmer than the ground and near ground air layer. In this discussed case, the upper layer warming is in most cases due to absorption of morning sun radiation. In cold climates like eastern Canada and especially at the Saint Lawrence River Valley, the temperature inversion leads to freezing rain. This is fuelled by moist and warm air coming from the Gulf of Mexico some 3000 km away! This "inverted" freezing rain, a sea water spray freezing on the deck and rigging (sea water icing), almost sank Ernest Shackleton's little *James Caird* on her way to South Georgia.[106]

The usual vertical gradient of temperatures is that the temperature of the air generally gets lower with increasing height. To measure temperature gradient, the lapse rate was introduced. The lapse rate is defined as a change in temperature observed while moving upward through the Earth's atmosphere. Obviously, this rate, like any meteorological variable, is dependent on many factors. However, on average it is about 6.5°C per kilometer (18.8°F per mile) in the lower atmosphere (troposphere).[107] The average lapse rate was calculated for the "average" case, that is, assuming that the atmospheric air layers were well mixed. This average case, however, rarely occurs, especially in mountainous regions.

Long before the question of air circulation in Antarctica was addressed, the issue of temperature inversion was well known and studied with the help of balloons and kites carrying self-registering thermometers. "It is important also to note that frequently in anticyclonic weather, and especially cold anticyclonic weather, there is often an inversion at the surface; the temperature increases upwards instead of decreasing."[108]

> Certainly one of the greatest triumphs of the German South Pole Expedition [*Gauss Expedition* (1901–03) –KS] was Dr Enrkow's successful carrying out of 255 ascensions on 209 days during the floe-drift journey in Weddell Sea. A preliminary computation indicates that the highest balloon sounding reached an altitude of 17,200 meters (56,430 feet or 10.7 miles). These series of flights furnish the first noteworthy data bearing on the upper-air conditions over the Antarctic regions, and we may well look forward expectantly to the general conclusions which this first pioneer work shall warrant.[109]

The business of taking measurements by using hydrogen filled balloons was not an easy one, especially during the winter time when the low temperatures and darkness considerably troubled the meteorological crew. Just to illustrate the possible difficulties and hardship, I cite the *Terra Nova Expedition* meteorologist Dr George Simpson[110]

> Monday, December 25th, 1911. – An attempt was made to reach as high as possible. A fuse for forty minutes was attached. Besides the small red balloon a frame carrying four sheets of silver paper was attached to the instrument. The instrument was detached 43 minutes after the ascent; but for some time before this the silver paper, and at times the instrument, was all that could be seen below the large balloon. When the instrument fell its course was followed by the flashing of the silver paper. The latter

> however slowly broke away, and when about 15° above the horizon became invisible. The theodolite was lowered and a bearing of the direction was taken, but as this cut right across Inaccessible Island it was not a good one. On setting out to find the instrument I travelled on ski for 2½ hours as near the bearing as possible, then I saw the small red balloon through glasses about a mile and half away. The instrument was safely picked up about ten miles from Cape Evans in a S.S.W. direction. (The instrument had risen 6,743 meters.)

But why assume it would be easy? At the turn of the twentieth century, Maria Skłodowska-Curie and her husband Pierre Curie, while working in a shack-like laboratory, shoveled tons of uranium ore (uraninite minerals) to extract tiny (*parts* of a gram) quantities of radioactive polonium and radium. Both of them received in 1903 a Nobel Prize in Physics (Skłodowska-Curie received in 1911 her second Nobel Prize in chemistry), but eventually she died because of a plastic anemia contracted from exposure to radiation. Although Pierre Curie was prematurely killed by a horse-drawn vehicle, he also was bound to develop radiation disease due to working with radioactive materials. Skłodowska-Curie was unjustly and wrongly hijacked to become an icon of the feminist movement.[111]

Dr Simpson's 2½ hour skiing effort to recover his instruments paid off. In addition to observations of smoke from the Mount Erebus volcano, he also collected upper atmosphere temperature data. Figure 1.5, which is taken directly from Dr Simpson's *Meteorology* volume I, illustrates the results of two sets of measurements[112] of air temperature as a function of the distance from the surface. The lines on the right side of this figure were obtained in November and December of 1911 (summer), and in August (winter) of the same year.[113] The difference between the sets of these curves is clear. During the summer, the lapse rate is approximately linear. However, winter measurements clearly show a temperature inversion, i.e. the air temperature is increasing with increasing height. The increase of temperature is not unlimited, and at about 700–750 m above McMurdo Sound, a slow but steady decrease of temperature with height begins to be observed.

The described conditions obviously can only be obtained during the absence of wind. Wind produces vertical mixing of the air without the aid of convection currents. The effect of a wind is different in summer and in winter. In the summer, there is already a large temperature gradient, which is little affected by the wind. In the winter, the wind removes the cold surface layer and produces a normal temperature gradient.[114]

Dr Simpson explains the observed temperature inversion in the following way[115]

> In the winter there is little or no sunshine, while rapid radiation takes place from the snow surface which cools the air in its immediate neighbourhood. A cold layer of air is thus formed, which, under favourable circumstances, may be many degrees colder than the air a few hundred metres above.

It is worth reading Dr Simpson's explanation again to discover its fallacy. At the South Pole, the Sun is down from Mar. 24th through Sep. 24th. Thus, during this time, no energy absorption of solar radiation is present. Therefore, the energy previously accumulated in ice and air should be lost into the outer layers of Earth's

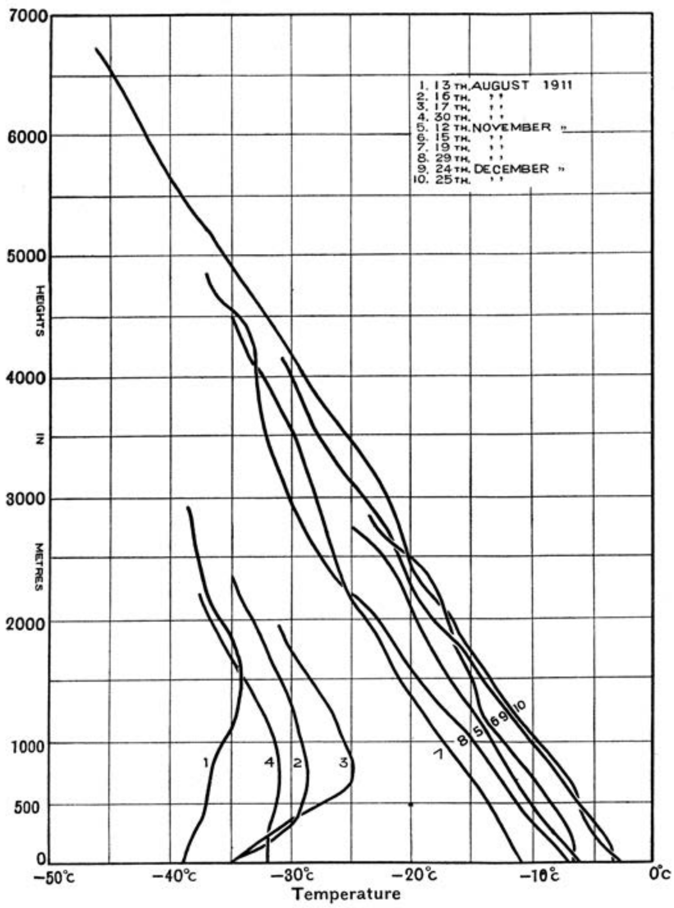


Figure 1.5. Upper air temperature measured by Dr George Simpson in 1911.[1]

[1] George C. Simpson, *British Antarctic Expedition, 1910–1913, Meteorology*, Vol. I, *Discussion*, Thacker, Spink, & Co., Calcutta, 1919, *cf.* p. 42.

atmosphere and outer space in the process of thermal equilibrium. Essentially, the energy would be "sucked out" by the processes of thermal radiation from the surface and near surface air. Although the Moon does not have an atmosphere like Earth, the temperature of its surface is changing from +100°C to –238°C depending on whether or not it is illuminated by the Sun's radiation.[116] This example shows the power of solar and thermal radiation. When not being illuminated by the Sun, the temperature of the Moon's surface would drop to over two hundred degrees below freezing.

On Fig. 1.6, I depicted the average *daily minimum* near surface temperatures recorded at three different locations (the South Pole, the middle of the Ross Ice Shelf, and Ross Island) in Antarctica. Throughout this book, I will use minimum near surface temperatures, which are defined as the *lowest* temperatures recorded during a 24h period. One can observe that as winter is approaching, the minimum daily

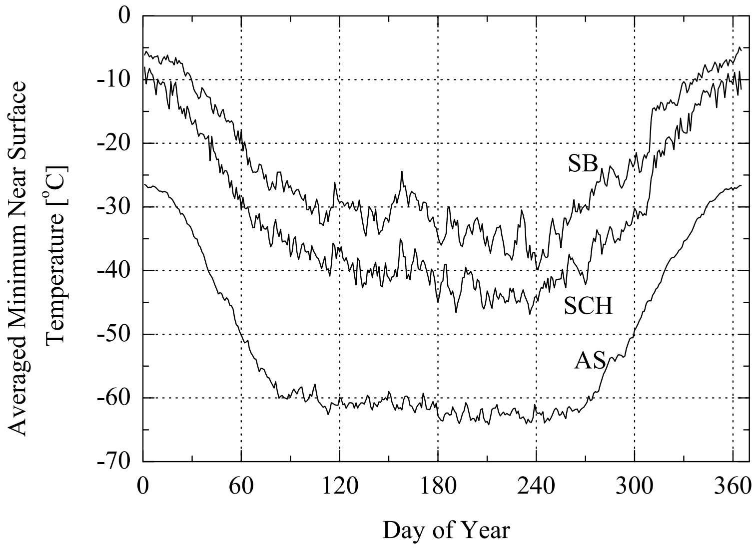


Figure 1.6. Averaged minimum near surface temperatures recorded at the Amundsen-Scott (AS) station (–90, 0), Schwerdtfeger (SCH) station (–79.904, 170.105), and Scott Base (SB) station (–77.85, 166.75).

temperatures drop sharply to arrive at a steady winter temperature. The coreless winter was observed by all expeditions as listed in Table 1.1 at different locations in Antarctica and reviewed by Glasgow native James Murray,[117] who was a biologist of Ernest Shackleton's *Nimrod Expedition*.

From Figure 1.6, one can see that the cooling process in Antarctica is not "limitless" like on Mars, but it is fluctuating at about –65°C during the whole winter with a slight downward trend. This behavior, combined with observations of temperature inversion, suggest that in Antarctica there must be present a process which regulates an otherwise unlimited cooling of the atmosphere. This process must constantly supply energy and quasi-equilibrium, as illustrated by an almost steady winter temperature. This process is due to constant and unusually strong advection of maritime air above the stable surface inversion layer. The maritime (moist) air is coming from the migratory circumpolar cyclonic lows originally discovered by Dr Arctowski, and which slide towards the Pole over a stable layer. Throughout this process, an adiabatic cooling of incoming moist (saturated with water vapor) air is observed. Even with a clear sky (blue sky), the moisture becomes supercooled resulting in the diamond dust (ice crystals) precipitation.

This is a general and simple mechanism of air circulation in Antarctica. These processes are responsible for diamond dust precipitation and formation of the Antarctic Dome (Plateau). This conclusion comes as a bit of surprise, in that precipitation of tiny and fragile diamond dust (ice crystals) led to the formation of the enormous Antarctic Dome. But not only on the continental scale may diamond dust arouse human interest. Anyone visiting Antarctica is always fascinated by the halo phenomenon[118] caused by diamond-like ice crystals.

1.3. Meteorology of the Ross Ice Shelf and McMurdo Sound

> *The keynote of my work has been physics and I have attempted to find the physical explanation of each of the meteorological phenomena observed. It will probably be found that many of my physical explanations are not sound and will not bear critical examination, still to me an imperfect physical explanation is better than none, for it acts as a thread to bind the facts together and being an object for attack may lead ultimately to a correct explanation while the mere statement of the facts might have been passed unheeded. Those who have the patience to read through this book will find many fascinating unsolved problems and these, I hope, will be incentives to further investigation both in the study and in the field.*
>
> George C. Simpson[119]

In the preceding section, I presented a general and simple description of global and Antarctic air circulation. In summary, on the basis of the works of Drs Arctowski, Meinardus, Hobbs, Lockyer, Simpson and others, it was shown that the near-surface winds in Antarctica form a centrifugal (outward) flow of surface air currents above inland ice masses. The fringes of the Antarctic are surrounded by a belt of migratory cyclones moving in the opposite direction from the surface anticyclones over the continent. The moisture of these cyclones, combined with air temperature inversion over Antarctica, provides a mechanism which creates precipitation of diamond dust (ice crystals) over the Plateau.

On a smaller scale, but directly related to Captain Scott's expeditions, is the meteorology of the Ross Ice Shelf, Ross Island, and McMurdo Sound. It appears now that if the Ross Island and its surroundings were not discovered by chance on Jan. 28th, 1841 by James Clark Ross, then access to the Antarctic interior would be very much limited and delayed, as was exemplified by the failures of Lt Shackleton[120] and Filchner's[121] expeditions, for example.

However, since James Ross' discovery, this region of Antarctica was and still remains a gateway to the continent. Since then, and up until now, knowledge of the meteorology of this region plays an important role in the daily human activity there. In particular, it is important to predict weather conditions at the Williams Field ski-way, Pegasus blue-ice runway, and the sea-ice runway, in the vicinity (west) of McMurdo Station. Predicting the weather at the time of landing of the aircraft departing from Christchurch, New Zealand is critical for human safety and the economy of transport.

Captain Scott's *Discovery* and *Terra Nova Expeditions* collected a great deal of meteorological data, where the essential weather features of the area were observed, described and understood. In particular, the following was established for the Ross Ice Shelf:

1. The near surface winds are anticyclone,
2. Air temperature inversion,
3. The Ross Ice Shelf air stream.

I have briefly described the discoveries of air temperature inversion and anticyclone direction movement of winds. Before proceeding further, one comment seems to be pertinent. As just described, meteorological phenomena were indeed observed and measured in Antarctica. However, these are meteorological observable facts, and not universal laws of physics, which are fundamental in describing nature. Therefore, the description of the meteorological phenomenon is a complex convolution of many laws of physics. This obvious complication leads to a certain blurring of the meteorological description of observables. A prime example is the frequently used in meteorological words "prevailing" or/and "dominant" related to winds at certain locations. These words mean that if you visited a particular place many times, then the wind direction observed would be in a prevailing direction, like in the case of the Westerlies or Roaring Forties. Someone, upon one of these visits, should be not surprised if the wind would blow in an entirely opposite direction.

In Antarctica, and especially at the time of Captain Scott's expeditions, the continuous meteorological measurements were taken at permanent stations at Ross Island. Because of the considerable recording time, the measurements revealed a prevailing wind direction at these locations. Out on the Barrier, as the Ross Ice Shelf was called by Captain Scott, continuous or reasonable length measurements were impossible. However, by looking down at the surface, one can make a simple yet important discovery.

> Before proceeding further with my narrative, I must mention the remarkable skill with which our sledge-drivers preserved the direction of their course, either when winding amongst large hummocks, or on the open unvaried field of snow, where there were no objects to direct the eye. They appeared to be guided by a kind of unerring instinct. This was especially the case with my Cossack driver, Sotnik Tatarinow, who had had great practice for many years. In the midst of the intricate labyrinths of ice, turning sometimes to the right and sometimes to the left, now winding round a large hummock, now crossing over a smaller one, among all the incessant changes of direction, he seemed to have a plan of them all in his memory, and to make them compensate each other, so that we never lost our main direction, and whilst I was watching the different turns, compass in hand, trying to resume the true route, he had always a perfect knowledge of it empirically. His estimation of the distances we had passed over reduced to a straight line, generally agreed with my determinations deduced from observed latitudes and the day's course. It was less difficult to preserve the true direction on a plain surface. To enable us to follow as straight a line as possible, we tried to fix our eyes on some remarkable piece of ice at a distance; if there was none such, we were guided by the wavelike stripes of snow (sastrugi) which are formed, either on the plains on land or on the level ice of the sea, by any wind of long continuance. These ridges always indicate the quarter from which the prevailing winds blow. The inhabitants of the Tundras often travel to a settlement several hundred *wersts* [Imperial Russian unit of length, ~1 km, (versta, верста) – KS] off, with no other guide through these unvaried wastes than the sastrugi. They know by experience at what angle they must cross the greater and the lesser waves of snow in order to arrive at their destination,

> and they never fail. It often happens that the *true* permanent sastruga has been obliterated by another produced by temporary winds, but the traveller is not deceived thereby, his practised eye detects the change, he carefully removes the recently drifted snow, and corrects his course by the lower sastruga and by the angle formed by the two. We availed ourselves of them on the level ice of the sea, for the compass cannot well be used while driving; it is necessary to halt in order to consult it, and this loses time. Where there were no sastrugi, we had recourse to the sun or stars when the weather was clear, but we always consulted the compass at least once in every hour.[122]

From the above lengthy citation, one may observe that this "simple" method of observing of sastrugi direction can serve as a navigational tool, as well as a source of meteorological knowledge. I have already mentioned about similar observations of the wind and ice-drift direction taken during the drift of the *Fram*. Nansen's observations led to the development and influence of Coriolis forces on the movement of sea water currents.

At this point, a careful analysis of sastrugi directions reported by different parties of the *Terra Nova Expedition* led its meteorologist, Dr George Simpson, to present a map of prevailing winds over the western part of the Ross Ice Shelf. I reproduced Dr Simpson's original map on Figure 1.7. About eighty years later, Dr Simpson's discovery was re-discovered by Drs Parish and Bromwich,[123] and the name Ross Ice Shelf air stream (RAS) was coined for the persistent and prominent low-level (near the surface) wind features seen in Antarctica. Sadly, Dr Simpson, and indirectly Captain Scott's expedition's original and fundamental findings, were not acknowledged.[124]

Let me return to the original Dr Simpson discovery, and his map depicted on Fig. 1.7. Dr Simpson, using letters indicated on this figure, indicated the prevailing wind directions at different locations. The general air flow was inferred from predominant sastrugi directions at the area. Dr Simpson explained[125]

> The general distribution of land can be seen on figure 37. The great mass of Ross Island is separated from the Western Plateau by the McMurdo Sound. Erebus is 13,000 feet high and its summit is only 12 miles from Cape Evans and between 40 and 50 miles from the tableland 9,000 feet high just across the Sound. It is quite clear therefore that these two masses which rise well above the lower winds must affect the flow of air in their neighbourhood. We are chiefly concerned with blizzard winds, we will therefore examine first the effect of the land distribution on these winds. If there had been a large number of observers taking simultaneous observations at many different points it would have been possible to show the actual motion of the air at any given time during a blizzard. As these observers were not present the next best thing is to examine observations taken at different times in different places during blizzards. This it is possible to do from the meteorological records kept by the various sledging parties. Also the directions of the sastrugi give valuable information as to the direction of high winds.

I will later return to a more detailed analysis of the prevailing wind directions, especially at Ross Island and at Cape Evans where meteorological observations were

taken during the *Terra Nova Expedition*. Here, I will just add Dr Simpson's comment on wind direction at the Barrier. "Position *I*. [as indicated on Fig. 1.7 – KS] –The winds at *I* and to the south are clearly indicated by the sastrugi which all point to the high winds coming from the S. or S.S.W."[126] While writing these words, Dr Simpson was well aware that the Ross Ice Shelf was bound at the west side by the Transantarctic Mountains, which rise up to 2000 m above barrier level. He was also aware of the meteorological reports of various parties which traveled on the Barrier along the Transantarctic Mountains. On the basis of this knowledge, Dr Simpson concluded[127]

> From figure 37 [see Fig. 1.7 – KS] it appears safe to conclude that during blizzards the wind streams along the west of the Barrier parallel to the edge of the high land. When this southerly stream impinges on Ross Island it breaks up into two branches one of which passes Cape Crozier as a S.W. or S.S.W. wind, and the other enters McMurdo Sound as a S.E. wind.

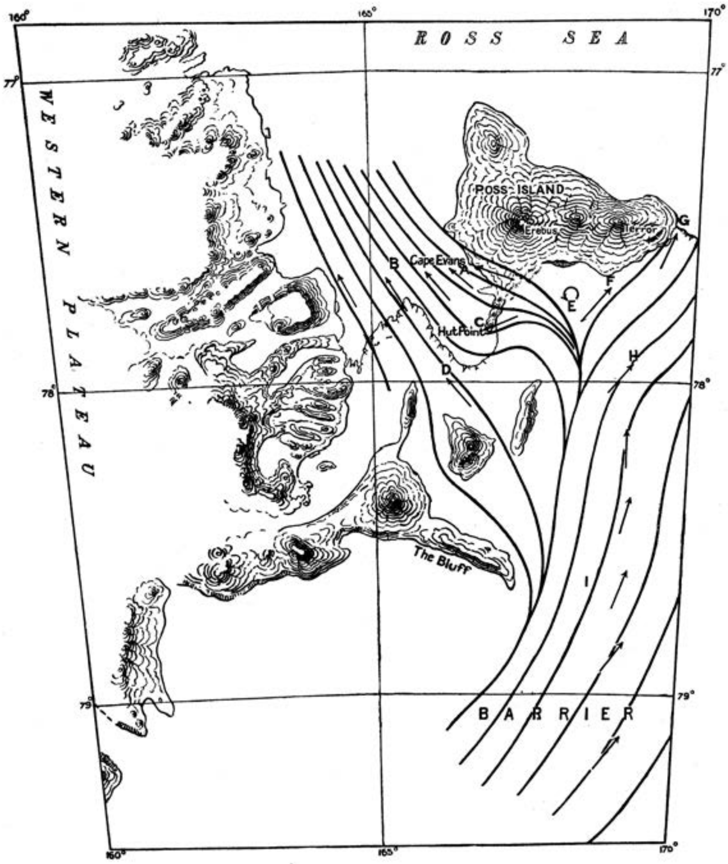


Figure 1.7. Dr George Simpson's (1919) depiction of near surface airflow around the Ross Island region during blizzards (solid lines).[1]

1 George C. Simpson, *British Antarctic Expedition, 1910–1913, Meteorology*, Vol. I, *Discussion*, Thacker, Spink, & Co., Calcutta, 1919, *cf.* p. 110.

Dr Simpson's conclusion about the existence of the Ross Ice Shelf air stream was later confirmed and studied in more detail by analysis of data from automated weather stations and satellite images.[128] The wealth of data has shown and proved that along Captain Scott's (and obviously Shackleton's) route on the Ross Ice Shelf – that is between the Ross Island and the entrance of the Beardmore Glacier – there is a persistent and prominent low-level (near surface) wind stream.

At the entrance to the Beardmore Glacier, Captain Scott's parties were stopped and held up in their tents for four long days by a blizzard, or gale as he called it in the *Message to the Public*. Captain Scott posited the question, "What on earth does such weather mean at this time of year?" and wondered[129]

> Is there some widespread atmospheric disturbance which will be felt everywhere in this region as a bad season, or are we merely the victims of exceptional local conditions? If the latter, there is food for thought in picturing our small party struggling against adversity in one place whilst others go smilingly forward in the sunshine.

In physics, and especially in quantum mechanics, a concept of locality plays a fundamental role. Albert Einstein formulated a criterion for the locality of two spatially separated physical systems S_1 and S_2 in that "the real factual situation of the system S_2 is independent of what is done with the system S_1.[130]

The answer to Captain Scott's question above is that along his path at the Ross Ice Shelf, local conditions do not exist. The consequences of this negative answer, resulting from the existence of the Ross Ice Shelf air stream, are enormous. A more detailed analysis in response to Captain Scott's question of "exceptional local conditions" will be presented in chapters 7 & 8 of this book. This analysis, based on investigations of near surface minimum daily temperatures and wind duration, will shed entirely new light on Captain Scott's *Terra Nova Expedition*.

Before proceeding with other issues related to Captain Scott, I have to add a small section which will be a more accurate description of wind observations in Antarctica.

1.4. Self-organized Criticality Wind Regime over Antarctica

> *How can the universe start with a few types of elementary particles at the big bang, and end up with life, history, economics, and literature? The question is screaming out to be answered but it is seldom even asked. Why did the big bang not form a simple gas of particles, or condense into one big crystal?*
>
> Per Bak[131]

I will not address the big bang question in this section. I will rather stay closer to Earth with everyday questions. Why do catastrophes happen? What sets off earthquakes? Why does the stock market periodically suffer dramatic crashes? Can global warming be properly measured in Antarctica by the current method of Principal Component Analysis? What is the nature of winds in Antarctica?

Just look around at the different sizes of things surrounding you. Get your magnifying glass and portable telescope and look at nature, the physical world. It would not take long for an investigative person to find the great diversity of sizes measured by the length of different structures.

In the preceding section, I described a general understanding of near-surface air movement in the western part of the Ross Ice Shelf. But I ask you to look at the movement of atmospheric air more carefully and simultaneously using the magnifying glass for your right eye and a lunette for your left eye. A difficult task, but one which must be done for science. Let us look through Lewis Fry Richardson's insightful eyes[132] of an unorthodox deviser of half-baked ideas whose name floats in and out of the history of applied dynamical systems[133]

> The kinetic theory of gases has revealed to us that the properties of viscosity, diffusion, and conduction of heat, which are attributable to a gas enclosed in a small vessel, are in reality due to molecular motions which we cannot follow in detail. In the same way in the atmosphere, many varieties of motion which we cannot or do not wish to record in detail, can be ignored; provided that their general statistical effect is taken into account by adding to the equations, describing the general motion, appropriate additional terms.
>
> It has been customary to separate circulatory motions in the atmosphere into two main groups according as they derive their energy from the local heating of the lower layers of air ("convection") or from the kinetic energy of the wind ("dynamical instability"). It is easy to classify a thunder-cloud as belonging to the conventional type, or a gust in a gale as being an example of the other extreme. But recent researches have shown the existence of numerous intermediate forms, which derive their energy from both sources jointly. Thus Åkerblom found that the eddy viscosity at the Eiffel Tower was greater in summer, when the supply of heat for convection was greater.

And after adding a few comments, Dr Richardson concluded in a wonderfully lyrical summary[134]

> We realize thus that: big whirls have little whirls that feed on their velocity, and little whirls have lesser whirls and so on to viscosity in the molecular sense.

It is clear that, as described by Dr Richardson, the turbulent processes of the whirls at many scales of length make contributions of equal importance. But how many whirls are present at different scales? Åkerblom, as mentioned above, had shown that "the eddy viscosity at the Eiffel Tower" is variable. It is easy to conclude that the number of scales should be also variable. If the system is driven to its critical state, then the scale of largest fluctuations become infinite and the smaller fluctuations are still present. The words "critical state" are used here in the context of statistical physics and describe the state of the system at the boundary between order and disorder. The system is infinitely sensitive to external perturbations, and while, in the critical state, strong correlations are observed between different parts of the system. To underline the intrinsic properties, these correlations are sometimes called self-similar correlations. Thus returning to Richardson's whirls, one should observe an emergence of collective phenomena, ranging from the bottom to top scale and connected by self-similar correlations.

Collective phenomena are commonly observed in non-equilibrium systems like for example life evolution,[135] flocks of European starlings,[136] and phase transitions. The collective behavior of these and many other systems result from intrinsic interactions, which systematically progress from micro to macroscopic level. The result of these interactions is a macroscopic object with self-similar structure and properties. Here, self-similarity is understood as the object being similar to a part of itself. Self-similarity is a basic property of fractals.

The work and insight of Australian Thomas Griffith Taylor,[137] who served in Captain Scott's *Terra Nova Expedition*, was and is appreciated to a degree which it deserves. Indeed, Dr Taylor gathered, presented, and researched a very wide spectrum of scientific issues. His books and research reports are an everlasting source of details and presentations of great scientific importance, even for modern scholars. Provided that the reader is curious, one can find in Dr Taylor's works many beautiful and deep scientific ideas. However, in one case, Dr Taylor described one very fundamental concept without being aware of its importance and consequences to science.

Here are figures (Fig. 1.8) directly taken from Dr Taylor's book *The Physiography of the McMurdo Sound and Granite Harbour Region*, Chapter XIII – Snowdrifts and Glacierets[138].

Fig. 80.—Sandstone cone with block 4 ft. high. Gondola Ridge. 2nd Jan., 1912.

Fig. 81.—Basalt cone with block 10 ft. high. Gondola Ridge. 31st Dec., 1911.

Figure 1.8. Dr Griffith Taylor's drawings of land features.

The question which I want to ask is – what is remarkable about these two figures? Although Dr Taylor was not as gifted in drawing as Wilson, who was also interested in painting nature, he depicted on figures 80 and 81 two very fundamental scientific concepts, which were developed in the late twentieth century. I will use these theories in this chapter to analyze Captain Scott's wind data.

The two fundamental concepts depicted by Dr Taylor are:

- Scale Invariance,
- Self-organized Criticality.

Dr Taylor informs us that "A few days after our arrival at Cape Evans the geologists were advised to inspect what our informants described as "little volcanic craters," which were seriously stated to be parasitic cones on the lowest slopes of Mount Erebus."[139] Apparently, "every officer in the hut had his own theory on the subject." The differences in guessing the origin persisted. However "Wright and I early decided

that they were quite possibly disintegration cones, but Dr Wilson thought their conical shape was due to supra-glacier streams, each cone having been gradually dropped from a notch in the edge of the ice front." Dr Taylor was right, and his conjecture was later supported by Debenham's observations based on the moraines of the Koettlitz region.

Although, he intentionally depicted scale invariance on both figures, he did not realize its fundamental importance and far-reaching consequences. One can see on these figures a little man, perhaps Taylor himself. The presence of the little man informs us about the scale of both cones. The relative size of the little man clearly informs us that the first cone is much smaller than the second one. Of course, this information would be unavailable to us if no little man was depicted, or the actual size was not directly measured.

On Dr Taylor's figures, the scale invariance concerns the invariance of the shape of cones. We learn about the invariance precisely in that a little man is depicted there. Using the height of the little man as a measurement unit, one can easily say that the height of the second cone is about 3.5 times of the first one. Additionally, an inquisitive reader may observe from these figures that both cones form an isosceles triangle, which has two slopes (sides) that are equal in length. Thus, in the case of cones depicted by Dr Taylor, we observe that the shape of these cones do not change if the lengths change. And this is exactly what physicists mean by scale invariance.

Also, by using the elementary Euclidian geometry theorem, known as the isosceles triangle theorem, one can conclude that the angles opposite the two equal sides are equal, and thus the slopes of both cones are equal. Another remarkable observation is that because these two cones are made of two different materials, sandstone and basalt, one may rightly conclude that the shape, and thus the slope of the cone *does not* depend on the initial material property. That is indeed an important observation and conclusion, and – as I will show later – leads to the above surrounding his second concept of self-organization criticality.

But for now, I will deal with scale invariance and return to Dr Taylor's description of glacierets, and yet again cite his insightful account[140]

> The most striking result of a blizzard on Cape Evans was the beautiful series of snowdrifts which were built up in the lee of every ridge which crossed the wind's direction. Many of these drifts are ephemeral, but others are found to consist largely of ice; the latter are of considerable age and have obviously been subjected to no external pressure.
>
> There was no line of demarcation between small ephemeral drifts, small "fossilised" drifts, small glacierets and large glacierets. They all merged into each other, and the latter were certainly only different in degree from small glaciers. Where a suitable bluff or ridge protected a large snowdrift from the planning action of the blizzard it endured, and gradually turned into ice; for, as I have elsewhere stated, the blizzard not only built the glacierets, but it also pruned them. After some of the strongest winter blizzards the glacierets and lake surfaces were polished to a mirror-like surface. Probably the size of a glacieret depends essentially on a balance between two blizzard factors, the snow contents of the blizzard acting positively and its velocity acting negatively. The glacierets on Cape Evans varied in size and thickness, but all had a similar shape and all were similarly oriented.

Dr Taylor describes the scale invariance. He plainly notices glacierets varied in sizes but similar in shape. However, "genuine scientific knowledge cannot be certain, nor can it be justified a priori. Instead, it must be conjectured, and then tested by experiment, and this requires it to be expressed in a language appropriate for making precise, empirically testable predictions. That language is mathematics."[141]

Not until 1967, when Dr Benoît Mandelbrot's seminal work was published in the American journal named *Science*, was such mathematical formulation of scale invariance finally presented. The title of the paper was enigmatic: "How long is the coast of Britain? Statistical self-similarity and fractional dimension."[142] The annotated paper is freely available from Dr Mandelbrot's website.[143] An important and somehow final realization as to how to present his results related to "power-law" came to Dr Mandelbrot after his examination of "Richardson's empirical data on coastline lengths". Already mentioned in the context of weather prediction, Lewis Fry Richardson studied a possible relationship between probability of two countries going to war and the length of their common border. Thus, the question was raised as to how to measure border length. If the coast of Britain was measured by a 100 km ruler, it would give a certain length of the coast. However, if the ruler was smaller, let's say 50 km, the measured length of coast increased. By taking an even smaller ruler, the length would increase again. Dr Richardson demonstrated that the true length of the British coastline increased without limit as the ruler's size was getting smaller.

Dr Mandelbrot summarized in his paper "Therefore, returning to Richardson's empirical law, the most that can be said with perfect safety is that it is compatible with the idea that geographical curves are random, self-similar figures of fractional dimension *D*." Thus Dr Mandelbrot formulated the language of mathematics in relation to the description of described above *self-similar* structures, and a number of years later the name *fractal* was coined[144] and used in countless papers, applications, and analysis.

Although it is not fully rigorous, one may say that a fractal is an object that looks the same on all scales. Certainly, the cones depicted by Dr Taylor look the same on all scales and one can find in his book more similar drawings.

Thus, scale invariance is one of the fundamental features of nature. In studies presented in this work, I have at many instances used and relayed on scale invariance. In particular, I have assumed, without being verbose about it, that Earth's atmosphere is described by classical continuity equations preserving air mass, energy, and momentum. These equations are scale invariant in spatial coordinates and time.

However, changes of air temperature or wind speed belong to a class of stochastic processes, of which the outcome is not described by a single quantity, but by a certain distribution of quantities. In here, a stochastic process is understood as a set of random processes, in which variables (temperature, *etc*.) may assume random values, and the evolution of the system over time is described by probability distributions. This means that even if the initial condition (or starting point) is known, there are many possibilities the process might go to, but some paths may be more probable and others less so. This is the fundamental difference between systems described by deterministic continuity and stochastic equations.

In the case of stochastic processes, the scaling is described by the likelihood of selecting a particular configuration out of all possible random configurations. These possible random configurations are given by probability distribution. While study-

ing different stochastic systems, it was discovered that scale-invariant probability distribution is observed in physical and biological to technological and social sciences. Indeed, the scale-invariant probability distribution was observed for an abundance of genes in various organisms and tissues, the frequency of words in natural languages, scientific collaboration networks, Internet traffic, as well as electoral results, urban agglomerations, firm sizes, and terrorism.

Examples of scale-invariant distributions are the Pareto distribution and the Zipfian distribution. Pareto distribution was discovered by the Italian scholar Vilfredo Pareto (1848–1923), who is best known for his observation later known as the Pareto principle. Mandelbrot comments on Pareto's work[145]

> One of Pareto's equations achieved special prominence, and controversy. He was fascinated by problems of power and wealth. How do people get it? How is it distributed around society? How do those who have it use it? The gulf between rich and poor has always been part of the human condition, but Pareto resolved to measure it. He gathered reams of data on wealth and income through different centuries, through different countries: the tax records of Basel, Switzerland, from 1454 and from Augsburg, Germany in 1471, 1498 and 1512; contemporary rental income from Paris; personal income from Britain, Prussia, Saxony, Ireland, Italy, Peru. What he found – or thought he found – was striking. When he plotted the data on graph paper, with income on one axis, and number of people with that income on the other, he saw the same picture nearly everywhere in every era. Society was not a "social pyramid" with the proportion of rich to poor sloping gently from one class to the next. Instead it was more of a "social arrow" – very fat on the bottom where the mass of men live, and very thin at the top where sit the wealthy elite. Nor was this effect by chance; the data did not remotely fit a bell curve, as one would expect if wealth were distributed randomly. "It is a social law," he wrote: something "in the nature of man".

While collecting and studying data on wealth and income, Pareto was concerned with continuous variables as both quantities and continuous, provided that a basic monetary unit is sufficiently small in comparison to the value of income. Pareto distributions are continuous probability distributions.

A discrete counterpart of the Pareto distribution was proposed and described in 1949 by the American linguist Dr George Kingsley Zipf,[146] who studied the frequency of words in the English language. Zipf's law states that the frequency of occurrence of the word as a function of its rank is a power-law function.

Both Pareto distribution and Zipf's law are effectively synonymous with power-law distribution, which is given by the simple equation

$$p(x) = cx^{-\alpha},$$

where $p(x)$ is power-law distribution, c is the additive constant, and α is the so-called tail *exponent* or *scaling* parameter. $\alpha > 0$ controls the rate of decay of $p(x)$ and hence characterizes its tail behavior.

The above equation is simple and beautiful. It just so happens that all fundamental equations of physics have a concise form. Originally, the power-law equation was discovered by observing individual wealth or word frequency. These observations

were made by plotting x on the horizontal axis and $p(x)$ on the vertical one, and examining what mathematical equation fit the data in the best possible way. Thus, Pareto and Zipf found that their data are best fitted by the mathematical formula shown above. Although the power-law was observed quite a long time ago, it was not until recently that its derivation from first principles was presented.[147]

Because of Zipf's work on word frequency, I will use the power-law to illustrate and examine several texts published in relation to the *Heroic Age of Antarctic Exploration*, namely the journals of Captain Scott, Captain Amundsen, Lt Shackleton, and Douglas Mawson. The word counts from James Joyce's novel *Ulysses* were analyzed by Zipf.

Word frequency is defined as a sum of occurrences of a given word in the text under analysis. A word rank is an integer number associated with the overall place on the word frequency list; the most frequently used word has a rank of 1, the second most used world has a rank of 2, *etc*. For us, equipped with modern computer tools, it is not a big deal to compute word frequency and rank in a given written language. Adding millions of digitized books, one can find the ranks of English words. The top ten words are: *the*, *to*, *of*, *in*, *a*, *and*, *for*, *that*, *is*, *on*. The rank of these top ten words is 1, 2, … , 10, respectively.

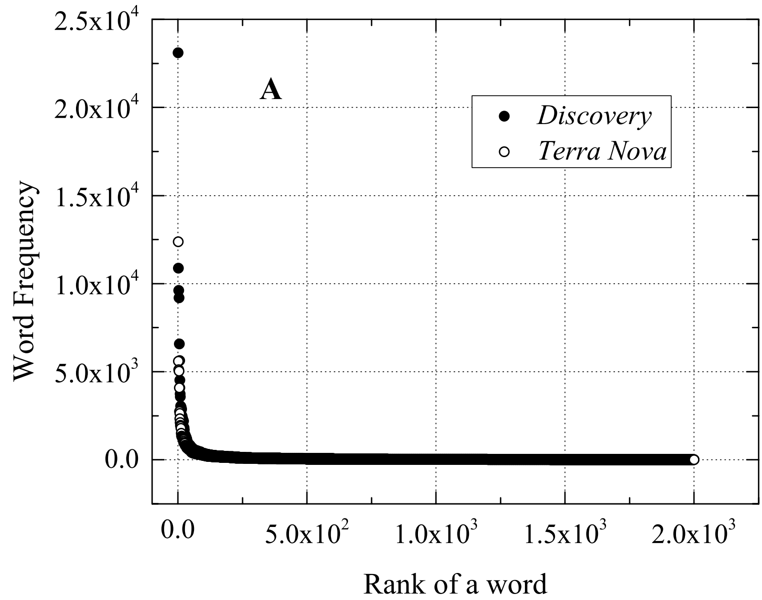
On Figure 1.9 A, I have shown a linear plot of word frequency versus rank of a word calculated from Captain Scott's journals of the *Discovery* and *Terra Nova Expeditions*, respectively. At first glance, the plot is cumbersome and hard to read. However, if the scale of the plot (but *not* data points) is changed to the logarithmic scale on both axes, a wonderful change is readily observed, Figure 1.9 B. This figure is a true representation of the data described by the power-law, including Zipf's law. One feature on this figure should be noticed. If the data under study is described by the power-law, then the data on a so-called log-log scale (logarithmic-logarithmic) should be a line with a slope $-\alpha$, as described by the power-law equation.

From this figure, one can see that Captain Scott's journals written during an expedition (*Terra Nova*) and after an expedition (*Discovery*) nicely follow Zipf's law. The difference between word frequency results from the different lengths of Captain Scott's journals.

The next Figure 1.10 shows combined plots of word frequency for different Heroic Age Expeditions and the English written language. And again, the difference in word frequency is due to the different lengths of these narratives. All plots follow the expected power-law. Thus, I have confirmed the otherwise well-known fact of Zpif's law, although some particularities may apply to polar exploration journals/narratives. Just to complete this small the research project, I have also performed a word frequency count (37,592,981 words) for my library of some 500 books (journals/narrative) on Arctic exploration. The conclusion is that the power-law holds at both the Antarctic and Arctic regions.

To finish my power-law comments for word frequency in the English written language, I wish to return to the original comments related to the scale-invariance of physics laws, physical phenomenon, and thus the above power-law equations. Power-law is scale-invariant.

Formally the power-law density is given by the above equation, $p(x) = cx^{-\alpha}$. The equation $p(x) = cx^{-\alpha}$ implies that the increments y are self-affine *i.e.* they obey the statistical scaling equality $p(ax) \overset{\text{def}}{=} a^{-\alpha} p(x)$, *i.e.* $p(ax) = c(ax)^{-\alpha} = ca^{-\alpha} \cdot x^{-\alpha} \propto p(x)$.



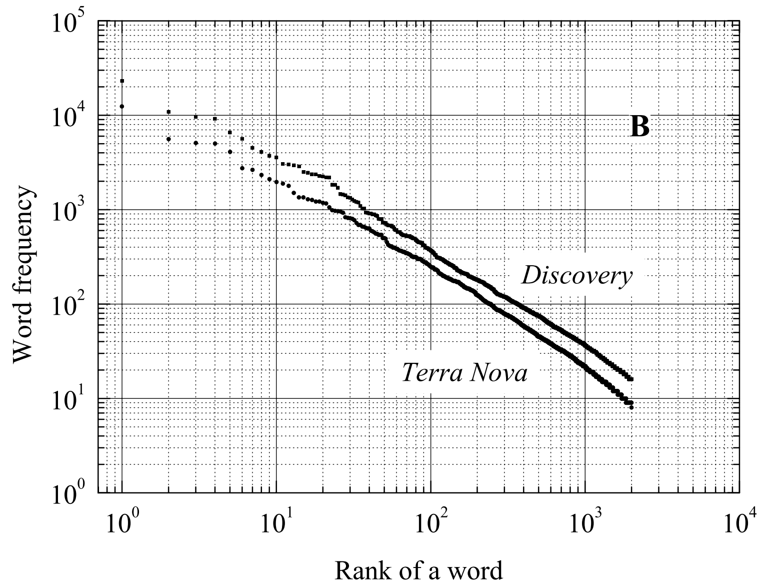


Figure 1.9. Word frequency versus rank of a word calculated from Captain Scott's narrative (journals) of the *Discovery*[1] and *Terra Nova Expeditions*.[2]

1 Robert F. Scott, *The Voyage of the 'Discovery'*, Vol. I and II, Toronto: The Copp, Clark Co., London: MacMillan and Co., 1905;

2 Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R.F. Scott, R.N., C.V.O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913.

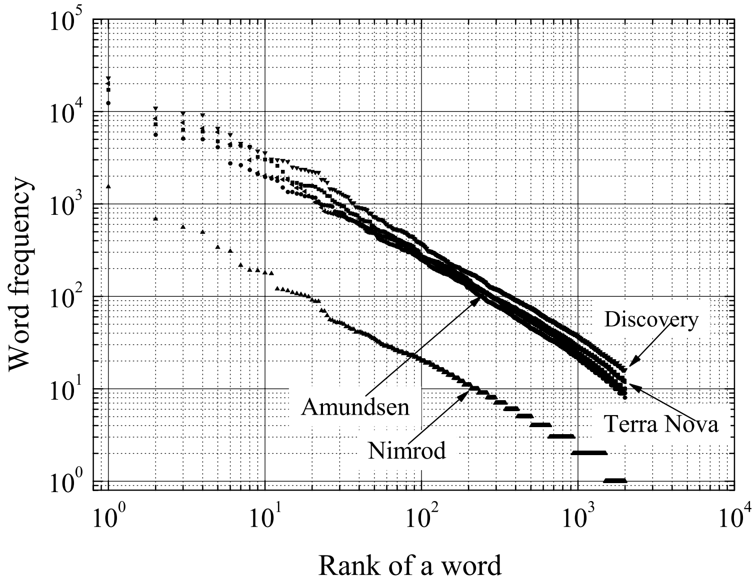


Figure 1.10. Word frequency versus rank of a word calculated from the narratives (journals) of the *Fram Expedition*[1], *Terra Nova Expedition*[2], *Nimrod Expedition*[3], *Discovery Expedition*[4], and *Mawson Expedition*[5].

[1] Roald Amundsen, *The South Pole: An Account of the Norwegian Antarctic Expedition in the Fram*, Vol. I and II, John Murray, London, 1912.

[2] Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R.F. Scott, R.N., C.V.O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913.

[3] Ernest Shackleton, *The Heart of the Antarctic, Being the Story of the British Antarctic Expedition, 1907–1909*, W. Heinemann, London, 1909.

[4] Robert F. Scott, *The Voyage of the 'Discovery'*, Vol. I and II, Toronto: The Copp, Clark Co., London: MacMillan and Co., 1905.

[5] Mawson, Douglas, *The Home of the Blizzard: Being the Story of the Australasian Antarctic Expedition*, 1911–1914, Vols. 1 & 2, W. Heinemann, London, 1915.

The common feature in systems governed by the power-law is the lack of a characteristic size, length or frequency for an observable x at the study.

From our point of view, this is a very important observation that the observable under study (measurement) is described by the power-law, and more importantly its changes *do not have* characteristic size, length and/or frequency. Thus, for such observables, one cannot use words like the average size and average duration, as the definition of average is reserved for systems where scaling is taking place. Consequently, one cannot use words like typical, mean[148], directional, *etc.* for stochastic systems where the probability distribution scales. There are many different and diverse systems having exactly this property.[149]

The reader may wonder about Zipf's law, its meaning and origin in describing of word frequency in the written English language. We are using words to describe complex thinking processes that involve word associations with objects and logical structures related to relations between objects. These associations and connections have multiplicative functionality, which drives word usage proportionally to a number

of connections (associations). Multiplicative properties are characteristic for non-linear systems, and thus the power-law is observed.

A Danish theoretical physicist, Per Bak, addressed an even more general question[150]

> How can the universe start with a few types of elementary particles at the big bang, and end up with life, history, economics, and literature? The question is screaming out to be answered but it is seldom even asked. Why did the big bang not form a simple gas of particles, or condense into one big crystal?

The answer to Dr Bak's question is that the big bang and nature are self-organized criticalities, which are displayed by non-linear complex systems. Dr Bak, with his colleagues, researched this question and came up with a simple and powerful account of self-organized criticality.[151] In here, the word critical and/or criticality is used in the context of critical phenomena described in statistical physics in connection to phase transitions at the border between order and disorder. The transition is usually described by strong correlations between different and remote parts of the system. Strong correlations and sensitivity to external forces result in cascades of correlations occurring at all scales in the system. Criticality is characterized by self-similarity of the correlations. Many natural dissipative dynamical systems tend to be in a critical state, with no characteristic time or/and length scale. The theory of self-organized criticality has its origin in various models for inanimate matter, like sandpiles, earthquakes, and in general in granular materials[152]

> To illustrate the basic idea of self-organized criticality in a transport system, consider a simple "pile of sand." Suppose we start from scratch and build the pile by randomly adding sand, a grain at a time. The pile will grow, and the slope will increase. Eventually, the slope will reach a critical value (called the "angle of repose"); if more sand is added it will slide off. Alternatively, if we start from a situation where the pile is too steep, the pile will collapse until it reaches the critical state, such that it is barely stable with respect to further perturbations. At the end of their article, they suggest: Finally, we invite the reader to perform the following home experiment. To demonstrate self-organized criticality, one needs a shoebox and a cup or two of sand-sugar or salt will do in a pinch. Wet the sand with a small amount of water, mix, and gather the sand into the steepest possible pile in one corner of the box. The angle of repose (*i.e.*, the threshold slope) is larger for wet sand. So as the water evaporates, one observes a sequence of slides – some very small, others quite large – occurring at random places on the pile. (The evaporation process can be sped up by placing the box on a warm surface, or under direct sunlight.)

The above-described experiment apparently works best[153] with short-grain Swedish rice. Self-organized criticalities in geophysics include earthquakes, landslides, snow avalanches, epizonal mineral deposits, and rainfall.[154] Although no data is available, I guess that the cones depicted by Dr Taylor are self-organized criticalities of granular matter.

Thus, the two figures drawn by Dr Taylor shown at the beginning of this section clearly depict self-organized criticality and scale invariant cones. In Dr Taylor's book, one can find many more figures (Figs. 75, 51, *etc*.) depicting self-organized scale invari-

ant geophysical structures. Obviously, to form these structures a great amount of time was necessary. It is pertinent at this moment to mention that stochastic processes, even geophysical ones, usually occur on shorter time scales than the observed cone formation. Frequently observed in polar regions, sastrugi are self-organized criticality systems of surface snow. "The directions of the sastrugi give valuable information as to the direction of high winds."[155]

With the knowledge presented above, one may return to study the meteorological record of Captain Scott's *Terra Nova Expedition*. From Captain Scott's journal, and especially from Dr Simpson's analysis, the difficulty of finding reasonable characteristics of changes of wind velocity in Antarctica is evident. Dr Simpson would not be a fine researcher if, despite obvious difficulties, he did not attempt to find at least some approximate description. While looking at wind velocity changes (structure of the wind as he called it) at Cape Evans, he observed[156]

> The most striking difference in the two sets of records is the great gustiness of the wind from the south compared with that from the north. In fact the record (A) of figure 38 exhibits a gustiness which is remarkable: during the hour 20 hours to 21 hours the wind rose to 74 miles an hour in a gust and fell a few minutes later to 10 miles an hour in a lull, i.e., a change of wind velocity of 64 miles an hour within a very few minutes. The gustiness which is so marked on this record was a characteristic feature of the winds at Cape Evans and will be discussed first.

To measure gustiness, Dr Simpson introduced a gustiness coefficient and proceeded with the analysis of wind velocity data. The gustiness coefficient for wind velocity was calculated for each 1 h window as a difference between the highest gust and lowest lull normalized (divided) by mean velocity during this period (1h). Dr Simpson analyzed the data and concluded[157]

> The gustiness of the wind at Scilly and Holyhead [Isles off Cornish peninsula and North Wales – KS] was found to be the same for all velocities; this however was not so at Cape Evans for table 66 shows that with an increase of velocity for both northerly and southerly winds the gustiness decreases. This does not mean that for high winds the actual difference in the velocity of gusts and lulls decreased, but that the ratio of this difference to the mean velocity decreased.

After observing the above, Dr Simpson proceeded with explaining the observed differences in relation to orography of Ross Island and a temperature inversion in a boundary layer. I will not follow his rationalization, and instead I will show that his analysis is fundamentally flawed.

Let me rewrite Dr Simpson's definition of the gustiness coefficient (say γ) into a handy small formula

$$\gamma = \frac{v_{\max} - v_{\min}}{v},$$

where according to Dr Simpson, $v_{\max}$ is the velocity of the wind in the highest gust, $v_{\min}$ is the velocity of the wind in the lowest lull, and v is the mean (average) velocity during the hour. The calculated gustiness coefficient for each hour was again averaged over a given period of time, like monthly variations, and depicted on Fig. 40 in Dr

Simpson's Meteorology book. Thus, the average of the averaged gustiness coefficient was obtained and used in the analysis of wind structure at Cape Evans, Antarctica.

Speaking about average, mean, expectation, ensemble average, and a probabilistic average of a given variable without knowing its probability distribution function is a very risky business. Such procedure hardly has any epistemological interest, as it does not provide insight into the nature of the problem and underlying laws.

The central limit theorem plays an important role in physics, and in particular in statistical physics. It describes systems where correlations among the different degrees of freedom can be neglected. Three fundamental postulates are needed in order to use the central limit theorem:

- the variables are independent,
- the variables are identically distributed,
- the variance of a variable is finite.

When for any reason one of the above conditions are not fulfilled, then the central limit theorem is not valid. The central limit theorem has an attractor, which is described by the famous and well known Gaussian (normal) probability distribution function. The requirement of independence and identical distribution of variables is understood to mean that any variable has the same probability distribution, and these variables are mutually independent.

The third hypothesis, of the finite variance of a variable, is the most interesting and investigated one. The variance of a variable is describing how far the numbers lie from the mean (expected value). It also requires that the mean (expected value) calculated over the whole distribution *exists*. The existence of variance means here that its numerical value is smaller than infinity.

This is precisely a case of Gaussian (normal) distribution for which variance is finite. This indicates that if you randomly select a variable from this distribution, its value will be close to the mean value of the distribution. All variables are "grouped" around the mean of the distribution.

The French mathematician Paul Pierre Lévy, while looking at postulates of the central limit theorem, asked about the variance of the variable: What if it isn't finite? Or alternatively: why must variance be finite? This reminds me of a similar story related to famous the Euclidian parallel postulate (The 5th Postulate), which eventually lead to the development of non-Euclidian geometry[158] and great advancements in physics.[159]

Dr Lévy assumed that the variance of variables under consideration is infinite. In such a case, the central limit theorem is no longer valid and must be replaced by another theorem, provided that an attractor in the form of a probability distribution can be found. Indeed, Dr Lévy was able to find a distribution function which presently bears his name and is called Lévy distribution (continuous probability distribution). On Figure 1.11, I have depicted the Gaussian and Lévy probability distribution function. The differences between these distributions are clearly visible, especially if one looks at the long tail of Lévy distribution. It can be shown that the Lévy probability distribution function has a so-called power-law tail ($p(x)$) which takes the unusually simple form of

$$p(x)=Cx^{-\alpha},$$

where C is a constant and α is a *scaling* parameter.

Of course, the reader would notice that the above power-law derived from Lévy probability distribution is in exactly the same form as an empirical Zipf's law described and presented in relation to rank ordered usage of words in Captain Scott's narratives and other narratives.

The investigative reader may wonder what an abstract mathematical proposition of Lévy may have in common with the real world. Is it possible that the variance may be infinite or have been an arbitrary big value? Intuition tells you that everything is limited and bounded by something. A human lifetime is limited, the dimensions of the atmosphere are limited, and the velocity of wind is restricted. The trick is that we know that an infinitely big wind event cannot take place, but by assuming infinite variance, then one is allowing to consider wind events which are not described by Gaussian (normal) distribution. These events one may call the outliers from Gaussian distributions and power-law distributions, and especially their long and "fat tail". Without accounting for rare wind events, the gustiness of the wind, one cannot fully understand the nature and characteristics of the wind.

Dr Simpson, who was looking at wind charts of wind velocities measured at Cape Evans, was fully aware of the presence of rare and out of the ordinary changes of wind velocity. While analyzing his gustiness coefficient, he noted, "It should be mentioned, however, that the gustiness was only determined for hours during which there was no sudden change in the mean wind velocity."[160] Dr Simpson's comment is actually fundamental in understanding power-law distributions, and especially the danger of calculating and using the mean velocity

To make his point, Dr Simpson continued

> Similarly, if the wind suddenly rises from a calm and a gust of, say, 30 miles an hour is recorded towards the end of the hour the difference between the maximum and minimum velocity would be 30 and the mean velocity during the hour, very small, say, 5 miles an hour. This would give a gustiness of 6 which would obviously be too high and quite misleading.
>
> The Antarctic records have been worked up for the twelve months, March, 1911, to February, 1912, inclusive. The mean gustiness for the period was 1.04.

By eliminating outliers, the rare events, Dr Simpson smoothed the real distribution of wind velocities to a Gaussian (or Gaussian-like) distribution. One of the most simple and direct methods for finding the distribution function of a particular variable is to plot its probability distribution. On Figure 1.11 A, I have shown the distribution of wind velocities recorded at New Zealand Scott Base station, located at the southern tip of the Hut Point Peninsula of Ross Island. Measured wind velocity is indicated by dots. On the same figure, I have also shown the best fitting of the Gaussian distribution function obtained by the least-squares method. It is easy to notice that for small wind velocities, the data points are relatively well approximated by the Gaussian distribution. However, if a velocity is steadily increasing, the measured data shows what is called in literature a "fat tail" or "heavy tail," contrary to the Gaussian thin tail distribution also depicted on this figure.[161] In this linear plot, the departure of the probability distribution of measured wind velocities from Gaussian (normal) distribution may not look as significant as claimed here. However, just a little change of data presentation shows their real nature. In the case of wide-ranging variables, the linear scale presentation is not the

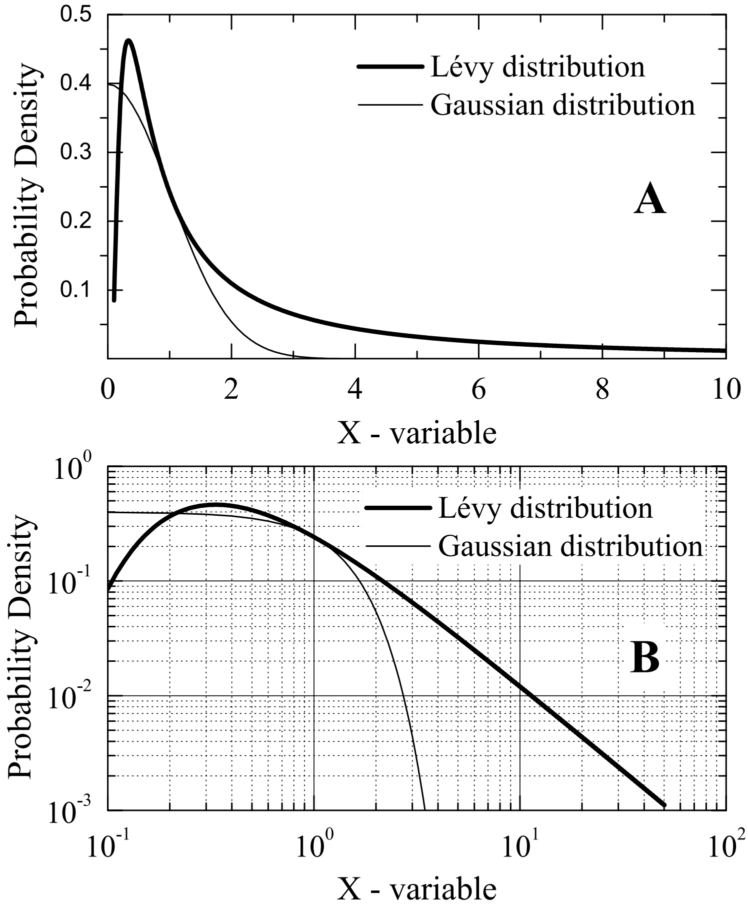


Figure 1.11. Illustration of the usefulness of a logarithmic scale presentation. A – linear depiction of the Lévy and Gaussian probability distribution functions and B – logarithmic transformation of figure A.

best choice. To reduce wide-ranging data to smaller ranges, the squeezing properties of the logarithmic scales may be used. An example of a scale which is logarithmic is the Richter magnitude scale, which was introduced to quantify the energy contained in an earthquake. The Richter scale is a base-10 logarithmic scale. A shaking amplitude of an earthquake that measures say 7 on this scale is 10 times bigger than the one which is at 6, and 100 times than 5 in the same scale.

To illustrate the usefulness of a logarithmic scale on Figure 1.11 B, I have depicted the logarithmic scale data linearly (Figure 1.11 A). The change is incredible, and illustrates the importance of selecting a suitable "reference frame". From my personal perspective, while working on my Ph. D. thesis I spent several years unsuccessfully trying to solve a master equation which I proposed to describe a random walk of excitation energy in molecular systems. While looking at this equation, I could not figure out the real-time ordering of events which eventually would lead me to find the solution. Then

one day, I used the Laplace transform to "eliminate" time from the equation. In a matter of an hour, the solution of the equation was written on a sheet of paper. It was indeed a revelation! As a matter of fact, the solution was in the Laplace domain, and the "*beam me up, Scotty*" to the real time domain remained a very difficult task.

The notion of probability does not have a singular definition and the debate is sure to continue. Here I will use frequency to define probability. Most of us learned about probability in high school; specifically using its frequency definition which attaches probabilities to events. In order to the find probability of event $P(A)$ one has to count a number of these events (n_A) and divide it by a total number of events (n_B). Thus, a measure of the probability of event is the relative frequency of occurrence of an event in a number of repetitions of the trials (experiment), $P(A) \approx n_A / n_B$. Provided that the experiment is repeated a great number of times, the true value of probability $P(A)$ should be obtained in the limit $n_B \to \infty$.

Returning to wind phenomena, one notices its general event-like structure: the wind blows, or it does not. The next figure, Figure 1.12, illustrates an example of near surface wind velocity recorded at Scott Base. It is easy to notice that from time to time, the recorded wind velocity is zero. Thus, the chain of wind events is a sequence of the wind and quiescent events. In order to measure the occurrence of events, one could simply count the time duration of the wind and quiescent events, respectively. However, if one looks closer at this figure, it becomes apparent that the wind blows not only at different durations, but also with different strengths, which is related to wind energy. Therefore, instead of counting minute wind velocities, it is much better and sound to think that the sum of all wind velocities, bounded by zero wind velocities, is a good measure of wind event *size*.

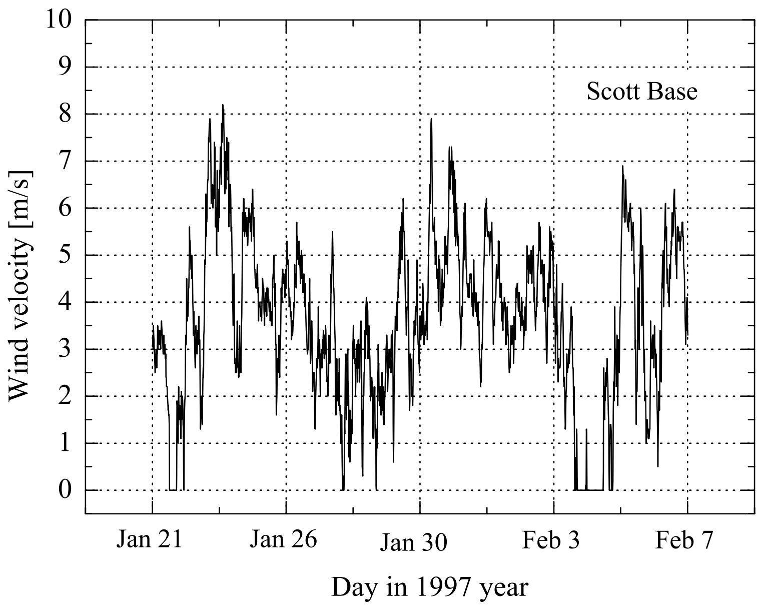


Figure 1.12. An example of wind event(s) recorded at the Antarctic New Zealand Scott Base station in 1997.

The first case of non-zero measurements of the wind velocity I will call the wind event size (w_s). I define the wind event as $w_s = \int v(t)\,dt \approx \sum v(t)\Delta t$ for *successive* non-zero wind velocities, where Δt is the size of the measurement bin. In the second case, the second and third variables can be considered to be the duration of the wind event (w_t) and the duration of a quiescent wind event (w_q), respectively.

I will continue this analysis with the data from Scott Base mentioned above. In my calculations, I used a record of near surface wind velocities measured at this station in the period from 1985–2010. The wind velocity at this station was measured every 10 minutes, and thus it gives about 1.3 million data points. It is not difficult to calculate each individual wind event size (w_s) and the total number of such events. On Figure 1.13, I depicted a number of wind events versus wind event size, which is by definition measured in minutes. The reader should notice that for better transparency, as discussed above, both abscissa and coordinates of this plot are given in the logarithmic scale.

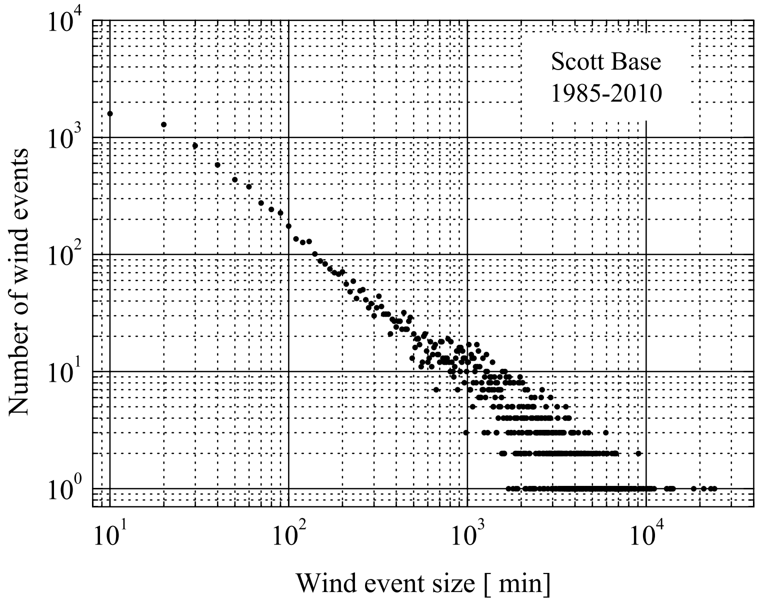


Figure 1.13. Number of wind events *vs.* wind event size recorded at Scott Base during the period 1985–2010.

If the data points of a number of wind events were distributed according to the Gaussian distribution function, then the data should match the plot of the Gaussian function shown on Figure 1.11A. In the logarithmic scale, the Gaussian function should decay as an inverted parabolic function ($\sim -x^2$). It is *apparent* that the calculated wind event size distribution at Scott Base, as depicted on Fig. 1.13, does not decay as suggested by the Gaussian distribution. Rather, it looks like a straight line! It decays like the Lévy distribution, which is drawn beside the Gaussian function of Fig. 1.11 B.

Indeed, the wind event size distribution at Scott Base behaves according to the power-law function as discussed above in relation to the Lévy probability distribu-

tion. On Fig. 1.13, I indicated "the best fitting" of the power-law function to the experimentally obtained wind size events. One should observe that the solid straight line obtained from the power-law rather nicely fits the experimental wind data points. As a result of a computer assisted fitting procedure, I obtained

$$p_s\left(w_s\right) \propto w_s^{-1.13} = p_s\left(w_s\right) \propto w_s^{-\alpha_s}.$$

More precisely the scaling parameter of wind event size at the Scott Base is $\alpha_s = 1.13 \pm 0.01$. This result is of great importance, and equally great consequence. First of all it shows, with its all consequences, that the wind velocity behavior at Scott Base station, located at the southern tip of the Hut Point Peninsula of Ross Island, is non-Gaussian. Actually, Dr Simpson one hundred years ago observed the non-Gaussian distribution of wind frequencies at Cape Evans and seven additional weather stations (Framheim, Cape Adare, Snow Hill, Gauss Station, Antarctic Plateau, Kerguelen, North Polar).[162] However, Dr Simpson did not look at these distribution functions from the perspective of underlining nonlinearity and self-organized criticality of wind events. Instead, by looking at the shape of these distributions, he discussed cyclonic and anticyclonic wind characteristics in Antarctica.

Of course, Dr Simpson, as well as the above mentioned Dr Taylor, observed scale invariance and self-organized criticality, but could not at that time give proper accounts of these phenomena. Because on each drawing Dr Taylor depicted his little man and/or geologist's hammer, one may conclude that he was aware of the importance of scale. However, Dr Taylor was trained to indicate the linear scale: a means of showing the scale of a map, chart, or drawing. His little man was a person of average height, whatever that meant at Dr Taylor's time. The scale of Dr Taylor drawings is invariant under additive actions, translations. More complex and fundamental is scale invariance under multiplicative actions. These multiplicative actions are common in self-similar processes, like for example fractals, processes described by power-law distributions, and Zipfian distributions. The scale invariance is a special feature of objects (Dr Taylor's cone formations) or laws (wind velocity distributions) that do not change if scales of length or energy are multiplied by a common factor.

John Venn, considered by many as a founder of frequency definition of probability, once observed that "Wind and weather are seen to lose their proverbial irregularity when examined on a large scale."[163] It is evident that Venn was referring to additive scale invariance. The weather is irregular on a particular day, but on a long time scale like one year, the weather shows certain similarities. The summertime comes to us in a one year cycle.

In the case of the power-law which describes probability distribution of wind events at Scott Base in Antarctica, the scale invariance means that the scaling by a constant (const.) simply multiples the original power-law distribution by the factor, const. $\cdot\alpha_s$. Therefore, it appears that *all* phenomena described by the power-law relationship are equivalent up to constant factors. The straight line on the logarithm–logarithm plot as shown on Fig. 1.13 is often considered as a signature of a power-law.

Now I can say that the wind size of the Ross Ice Shelf air stream as described almost one hundred years ago by Dr Simpson (as depicted on Fig. 1.7), is a self-organized criticality. But not only the wind size. I have also calculated wind *duration* distribution $p_t(w_t)$, and wind *quiescent* distribution $p_q(w_q)$ for a given data set at Scott Base. All wind characteristics, size, duration and quiescent time nicely follow

the power-law distribution confirming the apparent self-organized criticality of wind events at Scott Base.

Is there anything specific about Scott Base that leads the wind characteristics to behave as described above? The answer is no. By analyzing wind velocity data from about 40 meteorological stations scattered across the Antarctic continent, I have found that the data follows power-law distributions (see Table 1.2). Thus, the wind events at these sites (manned and automated weather stations) are a self-organized criticality. This is an important and fundamental property of the winds in Antarctica.

Table 1.2. Selected locations with respective scaling parameters.

Location /Scaling	α_s	α_t	α_q
The Antarctic Continent (AC)	1.06 ± 0.01	1.49 ± 0.04	2.26 ± 0.05
McMurdo (McM)	1.31 ± 0.07	2.27 ± 0.08	4.77 ± 0.16
Scott Base (SB)	1.13 ± 0.01	1.39 ± 0.03	2.68 ± 0.06
Schwerdtfeger (SCH)	1.27 ± 0.01	1.39 ± 0.03	2.46 ± 0.04

The observed self-organized criticality of katabatic winds suggests that the atmosphere over the Antarctic continent is organized into many interacting katabatic air cells forming the Polar Cell – a circumpolar near surface wind regime. The motion of these katabatic cells is driven by local rather than continental forces, predominantly by a downslope buoyancy forcing. Each air cell contributes to the katabatic air cell at a certain threshold. Hence, the air over the Antarctic Plateau piles up on ice sheet-formed gullies and valleys, while relaxing its excess along the contoured orography of coastal fringes or glacier slopes. At a given time, near surface air over the Antarctic continent contains a great number of volatile air cells dissociated by close-to-equilibrium relaxed air cells, or the opposite.

Volatile and relaxed air cells are transient. These cells are formed much faster than the slow time-scale of the driving force resulting from incoming solar radiation and the long-wave radiative loss to space. This process means the air system evolves through a sequence of states that are infinitesimally close to equilibrium in a cycle: driving, katabatic event, and relaxation. The transition between volatile air cells occurs through katabatic wind events, which restore and redistribute driving field forces. The katabatic wind events, duration, and quiescent wind events have no preferred scale, and their sizes and durations follow power-law distributions. The numerical values of the exponents depend on the geographical location measured by the slope of the Antarctic dome. The wind field over Antarctica is likely to be at a critical state. These are the essential factors of the mean field behavior of near surface katabatic winds in Antarctica, or over arbitrary ice domes on Earth or on other planets.

Let me return to Dr Simpson's studies of wind and wind gustiness coefficient as described above. Dr Simpson's gustiness coefficient contains a variable v which is the mean (average) wind velocity during the hour. We are accustomed in everyday life to say 'let's calculate the mean', 'on average', *etc*. But when asked about the actual meaning 'on average,' we immediately feel uneasy. Because the way that our schooling system was

set up, we were all educated in "the Gaussian world," where the central limit theorem dictatorship is absolute. The constitution of this world is simple: all variables are independent, identically distributed and the variance of a variable is finite. Provided that properties of variables are met, one can calculate the mean (average) value of all variables under consideration. Thus, such calculation is entirely justified and is a mathematically sound operation, which is defined by the simple relation

$$x = \int_0^\infty x p(x) dx,$$

where x is variable and $p(x)$ is the probability distribution function of this variable. In the case of the Gaussian probability distribution function, its substitution to the above equation leads to a finite value of the mean. However, in the case of power-law distributions the calculation of the mean is equally simple but the final result strongly (critically) depends upon the value of the scaling parameter α. Thus in the case of power-law distribution we have

$$x = \int_{x_{\min}}^\infty x p(x) dx = c \int_{x_{\min}}^\infty x^{-\alpha+1} dx = \frac{c}{2-\alpha}\left[x^{-\alpha+2}\right]_{x_{\min}}^\infty,$$

where $x_{\min}$ is the cut-off parameter. It is clear from the above formula that for scaling parameters $\alpha < 2$ the value of the mean becomes *infinite*, $x \to \infty$! It means that one cannot calculate (obtain finite value) the mean value of power-law distributed variables if the scaling parameter $\alpha < 2$. Just by looking at wind size scaling parameters given in Table 1.2, it is obvious that for McMurdo, Scott Base, Schwerdtfeger stations, and for the whole Antarctic continent, no mean wind size event exists. Equally small and big wind events may happen and the duration of these events is also unspecified and uncertain.

This principal difficulty of calculating the mean value of wind velocity was mentioned by Dr Simpson[164]

> It should be mentioned, however, that the gustiness was only determined for hours during which there was *no sudden change in the mean wind velocity*. [emphasis mine] That neglecting this rule would lead to errors can be seen by considering the hour 10–11 on figure 38 (A). In this hour the lowest lull occurs with quite a different mean velocity from that when the highest gust occurs. If one uses such hours it is obvious that the gustiness is made to appear larger than it ought to be. Similarly, if the wind suddenly rises from a calm and a gust of, say, 30 miles an hour is recorded towards the end of the hour the difference between the maximum and minimum velocity would be 30 and the mean velocity during the hour, very small, say, 5 miles an hour. This would give a gustiness of 6 which would obviously be too high and quite misleading.

However, Dr Simpson was incorrect by neglecting the sudden changes of wind velocity. His argument to neglect measurements was that while taking into account sudden changes of wind velocity, he obtained a gustiness coefficient of about 6 instead of 1.04.

What does it mean to say that a power-law distribution has no finite mean? First of all in the case $\alpha < 2$ the value of mean becomes *infinite*. This is not due to the

fact that the integration is taken to infinity. The same integral used to calculate the mean value of the Gaussian distribution gives a finite figure. The divergence of the mean value of the power-law for scaling parameters $\alpha < 2$ is an intrinsic property of power-law distribution. In the case of $\alpha < 2$ the mean x of the sample is dominated by the largest of the samples drawn from the power-law distribution. For a *finite* set of wind data, one can calculate the "mean", which will be finite. However, the "mean" calculated in such a way is not the mean. It is just a figure without the mathematical and physical meaning of the mean value. To get a more accurate value of the mean, one has to further increase the size of the sample from which the mean is calculated. In iteration the process of calculating the actual (true) the larger and larger samples must be drawn and hence the mean obtained increases without bound.

Now it is clear why Dr Simpson scrapped contributions of sudden change in the mean wind velocity in calculations of his gustiness coefficient. The analysis above of wind events has wider and more important implications. Namely, the question arises about the statistical properties of other meteorological parameters like wind direction, air temperature, pressure, *etc*. In the analysis which is beyond this chapter, I observed that for example the near surface temperatures at the Ross Ice Shelf do not follow the standard Gaussian distributions. Temperature change behavior is described by power-law distributions, with all their consequences. I am referring here to various reports of Antarctica warming during past decades.[165] These figures obtained by figures suggesting warming were calculated by using the so-called Principal Component Analysis (PCA), which is founded on the calculation of the mean value of temperatures. If the value of the mean temperature at a given location cannot be performed, the usage of the PCA method is meaningless, and suggestions of the warming of the Antarctic, or global warming if it relied heavily on the PCA method being applied to measurements from Antarctica, would be in question.

1.5. Meteorological Games – False Charges Against Lt Charles W. R. Royds

Nullius in verba[166]
The Royal Society's motto

Charles W. R. Royds (1876–1931) was a lieutenant in Captain Scott's *Discovery Expedition*, and "had all to do with the work of the men and the internal economy of the ship in the way that is customary with the first lieutenant of a man-of-war."[167] However, after the expedition's landing at a rocky peninsula named Hut Point on Ross Island, Lt Royds was in charge of meteorological work for the expedition.

The Royal Society of London for Improving Natural Knowledge, known as the Royal Society, needed about four years to publish the results of the *Discovery Expedition*'s meteorological scientific data, which it did in 1908. The publication's lengthy title was *National Antarctic Expedition 1901–1904, Meteorology – Part I: Observations at Winter Quarters and on Sledge Journeys with Discussions by Various Authors Prepared under the Superintendence of the Director of the Meteorological Office with the Co-Operation of a Committee of The Royal Society.*

The title of this publication is very descriptive about the volume content. However, not only the meteorological data and their analyses were inside. There was a bombshell planted. It was a well orchestrated "*coup d'état*" against Captain Scott. The coup contained all the essential elements: pre, due, and after actions of various perpetrators of these evil actions. Their efficiency is indeed stunning. One hundred years after these false allegations were formulated, historians like David Crane and David E. Yelverton did not research the issue, and only repeated its essential elements. Crane even formulated an unjustified and unscholarly thesis that: "Scott's resentment of criticism seems to have taken on a stridency that blurred the bounds between rational defiance and pigheadedness."[168]

The Victoria Barrier, or as it was renamed letter the Great Ice Barrier and/or the Ross Ice Shelf, was discovered in the Ross Island area by James Ross[169]

> As we approached the land under all studding-sails, we perceived a low white line extending from its eastern extreme point as Jan. 28. [1841 – KS] far as the eye could discern to the eastward. It presented an extraordinary appearance, gradually increasing in height, as we got nearer to it, and proving at length to be a perpendicular cliff of ice, between one hundred and fifty and two hundred feet above the level of the sea, perfectly flat and level at the top, and without any fissures or promontories on its even seaward face. What was beyond it we could not imagine; for being much higher than our mast-head, we could not see anything except the summit of a lofty range of mountains extending to the southward as far as the seventy-ninth degree of latitude.

To appreciate the full extent of these icy "Cliffs of Dover," Ross's squadron turned eastward and sailed 250 nautical miles along the barrier. After twelve days under sail[170]

> The bay we had entered was formed by a projecting peninsula of ice, terminated by a cape one hundred and seventy feet high; but at the narrow isthmus which connected it to the great barrier it was not more than fifty feet high, affording us the only opportunity we had of seeing its upper surface from our masts-heads: it appeared to be quite smooth, and conveyed to the mind the idea of an immense plane of frosted silver.

Turning back, James Ross and his two ships *Terror* and *Erebus* returned to Ross Island and discovered on its westward side a wide and ice-free sound. "I named it McMurdo Bay after the senior Lieutenant of the *Terror*, a compliment that his zeal and skill merited."[171]

Thus, instead of finding the magnetic south pole, James Clark Ross found two gateways to the continent's interior: the icy bay later called the Bay of Whales or the Balloon Inlet, and McMurdo Sound with its ice-free fringes of the Ross Island. The Bay of Whales was later used by Borchgrevink,[172] Amundsen,[173] and Byrd's[174] expeditions as a landing point. McMurdo Sound was taken by the British at a certain point, and it was even claimed by Captain Scott, supported by Dr Wilson, as his private (personal) area of exploration. Ruthlessly forcing Ernest Shackleton and his *Nimrod Expedition* to not use landing points at Ross Island puts a shadow on Captain Scott's genuine interest in pursuing scientific interests.

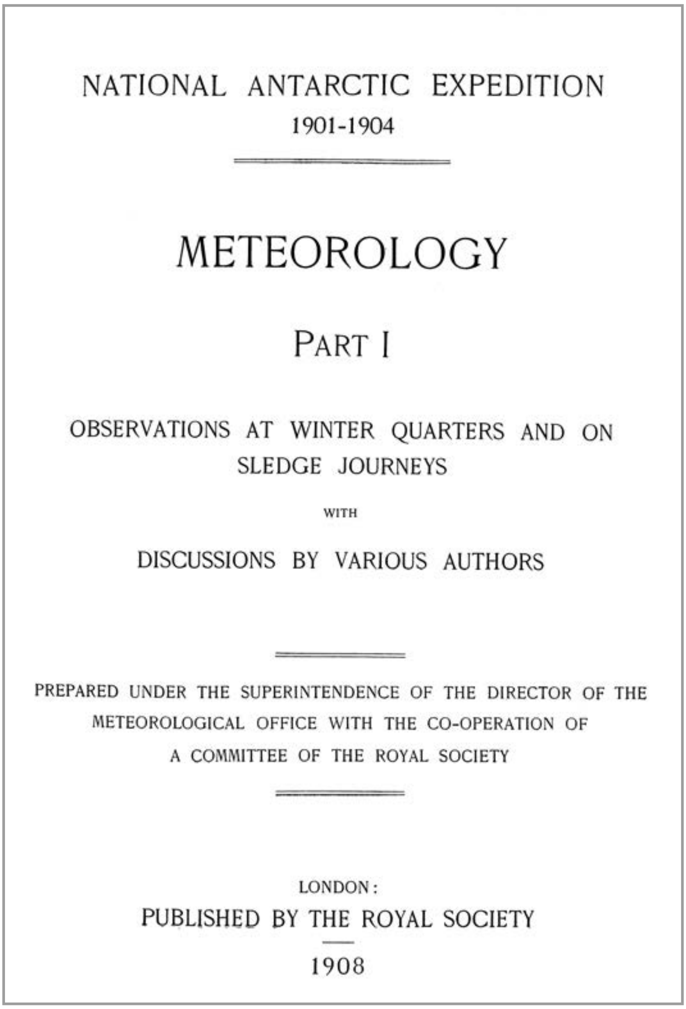
The then Commander Scott during the *Discovery Expedition* explored the Barrier by sailing eastward along the Ross Ice Shelf as far as King Edward Land. Before returning to Victoria Land on the way back (westward), the *Discovery* entered the bight visited previously by Ross and Borchgrevink. Commander Scott recorded "At an early hour on this day, February 4, [1902 – KS] we commenced to make preparations for a the balloon ascent to extend our knowledge of the surrounding region."[175] Commander Scott, as the leader of the expedition, took an unwise decision to be the first *aëronaut* in Antarctica, and while looking south observed "In the far south a bank of cloud had all the appearance of high land, but such indications are now too well known not to be received with caution, and even as I looked through my glasses, faint changes in outline were perceptible."[176]

I suppose that both Commander Scott and later Captain Amundsen had to wonder, was it land or just an optical illusion? The final and conclusive answer was given several years later by Captain Amundsen. However, before that Commander Scott dispatched on Nov. 10th, 1902 a small party of six under the command of Lt Charles W. R. Royds and with expedition physicist Louis Bernacchi,[177] who before the *Discovery Expedition* had traveled south under Borchgrevink. The party not only aimed to explore unknown regions of the Ross Ice Shelf, but also to make magnetic and meteorological observations. The journey was uneventful, and after reaching 79°35′S, 176°55½′E without sighting new land, the party turned back to expedition quarters at Hut Point where they arrived on Dec. 10th.

The meteorological variables recorded by Royds constituted a part of the *Discovery Expedition*'s meteorological record, which was submitted to the Royal Society for preparation and subsequent publication. That is at least what everybody, including Captain Scott and Lt Royds, had expected. A hefty volume with more than 500 pages and maps, with the subtitle *Meteorology – Part I*, was published by the Royal Society in London in June 1908.[178] The publication was prepared under the superintendence of the Director of the Meteorological Office, with the co-operation of a Committee of The Royal Society.

At that time, Dr Sir William Napier Shaw was the Director of the Meteorological Office. Scientific Control was provided for by a committee appointed by the Royal Society, consisting of Mr. J. Y. Buchanan, Dr C. Chree, Mr. W. H. Dines, Admiral Field, Dr Glazebrook, Sir J. Murray, Dr W. N. Shaw, Captain Tizard, Mr. C. T. R. Wilson, Mr. H. N. Dickson, Mr. Ferrar, Mr. A. J. Herbertson, Dr H. R. Mill, and Lt Royds.

The volume contained a Preface written by Sir William Napier Shaw, followed by explanatory notes concerning instruments and their exposures written by Royds. Then the meteorological journal of the *Discovery* was included and was followed by journals of observations on sledge journeys, including Lt Royds and Mr. Clarke's report titled *To the South-east Across the Ice-barrier*. The summary of base camp meteorological observations followed this report. The section containing the data was concluded with summaries of meteorological data taken simultaneously by the German (*Gauss Expedition*), Scottish (*Scotia Expedition*), and Swedish *(Swedish Antarctic Expedition)* expeditions. The final part of this volume contained a summary review of the *Discovery Expedition* data by various scholars, including chapter XII: *Discussion of the Observations of the Direction and Force of the Wind at Winter Quarters and on the Sledge Journeys* written by Richard H. Curtis, who was related to the Meteorological Office,



NATIONAL ANTARCTIC EXPEDITION
1901-1904

METEOROLOGY

PART I

OBSERVATIONS AT WINTER QUARTERS AND ON SLEDGE JOURNEYS

WITH

DISCUSSIONS BY VARIOUS AUTHORS

PREPARED UNDER THE SUPERINTENDENCE OF THE DIRECTOR OF THE METEOROLOGICAL OFFICE WITH THE CO-OPERATION OF A COMMITTEE OF THE ROYAL SOCIETY

LONDON:
PUBLISHED BY THE ROYAL SOCIETY
1908

Figure 1.14. The front page of Captain Scott's meteorological data from the *Discovery Expedition*.

and published several papers on winds and wind velocity measurements and its relation to the Beaufort scale.[179]

The Preface to the volume written by Sir William, the Director of the Meteorological Office, is indeed highly hypocritical. Just imagine, the *Discovery Expedition*, considered at the time as the most prestigious, important, and national pride-imbued expedition returns on Sep. 10th, 1904 from Antarctica with the whole spectrum of scientific results. Some of these results are meteorological measurements, and these observations are of fundamental importance in understanding global air circulation, as I have outlined above. Having this knowledge, Sir William casually informs the readers[180]

> The Meteorological Council, whose staff was already overloaded with material collected in the ordinary course of office business, were not prepared to accept responsibility for this additional volume of data. Undoubtedly, had circumstances permitted, it would have been advisable to detail a special staff for the work under the control of a competent meteorologist, who would have been responsible for the issue of a complete report upon the observations. There were two objections to this obviously desirable course. First, competent meteorologists in this country were all too fully occupied to be able to devote the necessary time to the supervision; and, secondly, a meteorological staff requires some training and experience for which, in this case, no provision was available.

The meteorological tables of the *Discovery Expedition* are printed in the volume from page 17 until page 408. It would take about one year of non-demanding work for *one* computer (person) to copy *one* page per day. But for the director of the British Meteorological Council, "competent meteorologists in this country were all too fully occupied". In order to resolve the issue, and to work on the meteorological data of the *Discovery Expedition*[181]

> It was eventually decided that the work should be done in the Meteorological Office under my general supervision, the office staff being increased for the time being by a few additional clerks in order to set free experienced tabulators and computers for the work of critical examination. The expense was charged against a guarantee of the Royal Geographical Society, but ultimately placed upon the funds of the Expedition.

Returning to Table 1.1, one may notice that five years publication time for the *Discovery Expedition* meteorological results is one of the shortest for all expeditions of the *Heroic Age of Antarctic Exploration*. The longest belongs to the *Nimrod Expedition* data, eventually published by Dr Kidson in Australia more than twenty years after the expedition's return. While reviewing this publication, *Terra Nova Expedition* members Charles S. Wright and Raymond E. Priestley commented that "No better example of this difficulty could be provided than the case of the Shackleton Expedition 1907–09, the scientific results of which have been largely lost through lack of funds to publish them, or have lost in value through delay in publication."[182]

The difficulty experienced by many leaders of expeditions in raising sufficient money to ensure adequate publication of scientific results[183] is telling in that the private sponsors and the government institutions did not care about so frequently stressed scientific interests and a general importance of science in Antarctic exploration.[184] In fact, more than one scientific publication from the *Terra Nova Expedition* carries the following notice: "The cost of the preparation and publication of this report has been defrayed from the Fund which was raised by public subscription in memory of Captain R. F. Scott and his companions."[185] By using the Google Scholar search engine,[186] one can look at citations of Dr Kidson's collection of the *Nimrod Expedition* results. Since its publication, Dr Kidson's collection was cited four times, including one of my own citations in relation to Captain Scott. It is indeed a poor ratio between scientific publication and scientific publication success. If science has borne out this particular ratio, then the previous lack of interest of the public in science was justified.

Therefore, the mysterious relationship of science, scientific interests, and Antarctic exploration appears as a *façade*.

This obvious fact was known to the establishment working on the publication of Captain Scott's meteorological record: that the public will not read this obscure publication. Without public participation, or better to say, without the use of alleged public discontent, the aim of the coup would be not achieved.

In the previous section of the present chapter, I have outlined my research related to polar air circulation. Although it was far from being proved by field observations at the beginning of the twentieth century, it was believed that a general prevailing anticyclonic near surface wind must dominate over Antarctica. A combination of outward air flow from the South Pole and the Coriolis force create anticyclonic conditions and a general easterly wind direction. The wind blows from the East towards West, provided that no additional factors influencing wind direction are present.

Sir William Napier Shaw investigated general air circulation and published two papers in the Quarterly Journal of the Royal Meteorological Society, with a summary account in the American journal *Monthly Weather Review*. By analyzing global pressure distributions, Sir William concluded that "The result of the pressure distribution due to the lower stratum alone would be a circulation around the polar axis from the east to west along lines almost identical with the lines of flow for the upper air, but in the reverse direction."[187]

Thus, according to the Director of the Meteorological Office, the near surface winds in Antarctica *must* be in an east to west direction. The prevailing wind directions measured at the *Discovery Expedition* quarters confirmed Sir William's analysis. However, I presume that it was a revelation to Sir William to learn that wind directions recorded by Lt Royds during his sledge journey toward the heart of the Ross Ice Shelf were on the contrary! In the Introduction to the volume, Sir William commented

> Mr. ROYDS' observations are nearly all printed S.W., but it is curious that the deviation of that direction from the easterly direction observed at Winter Quarters and Cape Armitage is actually the deviation of the compass in that locality. There is no entry in the registers to show how the direction was obtained, nor whether the original entries were magnetic or true. Cross-examination of the members of the Expedition who visited the Office led to varying opinions, but finally Mr. ROYDS wrote (2nd May, 1907), "I believe on some other occasions wind has been entered as magnetic, but I do not remember doing it on that journey; in fact I am sure I did not." They are therefore printed as they stand.

Alea jacta est! The above comment is indeed strange and odd. The author, without providing any scientific argument or reference, but only relaying on its own *curious* observation, disregards Lt Royds' filed observations. Sir William's comment was placed in the Introduction to the volume, and one may assume to find more analysis inside in the following chapters. Indeed, in Chapter XII, Richard H. Curtis presented what he called a discussion of observations of wind directions at home base and Lt Royds' sledge journey. Instead of presenting evidence that Lt Royds did not report true but magnetic wind directions, Curtis added his own unfounded comments, and he wondered[188]

> On the other hand, if we suppose the observations to have been corrected for variation before their entry in the log, we find ourselves confronted with a problem it is not easy to solve: How are we to account for the existence of a steady south-westerly current within a few miles of the ship [*Discovery* – KS], whilst at Cape Armitage and at the ship herself, although quite open and unsheltered towards the south-west, easterly winds were experienced almost exclusively, a south-west wind being of extremely rare occurrence, and a westerly wind practically never felt at all?

Clearly, Curtis did not say why he expected that the true direction of winds on the Ross Ice Shelf should be from the east towards west. That is, in the direction of an anticyclone deduced from the publications of Sir William. Therefore, Curtis suggested that the wind directions reported by Lt Royds were magnetic directions and correction for true directions was needed. The true geodetic north differs from magnetic north by an angle called *magnetic declination*. The present magnetic declination at McMurdo is 143°E. In other words, the magnetic compass needle points 143° east of the geographic south pole. Table 1.3 presents a part of the original table from Curtis' discussion. One could notice that in spite of suggested correction of directions, thus corrected by Richard Curtis, the directions are not in accordance with those at the McMurdo area, which are predominantly south westerly. Additionally, and what was pointed out by Captain Scott, was that the correction was calculated in the wrong direction. Instead of for example E. by N., the direction N. by E. should be calculated.

Table 1.3. Part of a table prepared by R. H. Curtis in his "Summary of the wind observations made on some of the longer Sledge Journeys."[1]

Journey of Lieutenant Royds, R.N., to South-east across the Ice Barrier, November 10 to December 9, 1903.

	S.E.	S.S.E.	S.	S.S.W.	S.W.	Calms.
Percentage of observations under each point	per cent. —	per cent. 6	per cent. 20	per cent. 6	per cent. 68	per cent. 25

	N. by E.	N.E. by N.	N.E. by E.	E. by N.
Percentage after applying a mean correction for variation of 145° E .	per cent. 6	per cent. 20	per cent. 6	per cent. 68

Total number of observations, 235.
Greatest distance and bearing from the ship, S. 42° E., 167 miles.

1 *National Antarctic Expedition 1901–1904, Meteorology – Part I*, The Royal Society, London, 1908, *cf.* p. 490.

However, nobody, including Sir William Napier Shaw and Dr Curtis, was interested in the analytical examination of the issue. To engage the public, a 'review" article was arranged and published in the *Times Literary Supplement* [*sic*] shortly after the *Discovery Expedition*'s meteorological record was printed. The reviewer rumbled[189] "How much longer [*sic*] shell we have to wait in England for these entrusted with national affairs to appreciate a little more seriously the requirement of scientific investigation? Probably until the constant leakage and loss which we suffer in ignorance are made plainer by one or more exceptional disasters."

In response, it was obvious to Captain Scott that only an official and possibly public inquiry could clear his and Lt Royds' names. The idea to call for an inquiry was that so Captain Scott could use the principle that one is considered innocent until proven guilty. This principle would force Sir William and others to clearly spell their arguments. However, Sir Archibald Geikie, the president of the Royal Society, choose not to call for an inquiry and suggested that it was "a subject best left in deserved oblivion". I am certain that if the matter stood before a British court, then Lt Royds and Captain Scott would be pronounced innocent. The burden of proof rests on who asserts, not on who denies, unless one is specifically dealing with the British libel courts.

A year later, when preparations for the *Terra Nova Expedition* were well under way and Captain Scott could not be stopped, Sir Archibald revealed himself to be an opportunist and offered to include Captain Scott's objections in the forthcoming second volume of meteorological records of the *Discovery Expedition*.

The second volume of the *Discovery Expedition*'s meteorological data under the title *Meteorology Part II: Comprising Daily Synchronous Charts 1st October, 1901, to 31st March, 1904* was published in 1913 by the Royal Society, just after the news of the deaths of the South Pole party reached England and the world. Sir Archibald, instead of ensuring that the question of wind directions was investigated, preferred to lament over the tragedy with "profound sorrow with which the loss of these brave men has filled the hearts of all those who were associated with them in connection with Antarctic exploration and its problems."[190]

He also hypocritically appealed to science and scientific causes: "We looked forward to their return home, bringing with them another and still ampler harvest of results. They have lost their lives in the cause of science, but their names are now imperishably graven on the bede-roll of the heroes of polar discovery."

But Sir Archibald's only concern was his personal well being. The meteorological data of the *Terra Nova Expedition* was published ten years later by Dr Simpson, preceded by Dr Simpson's discussion of this data in volumes from an obscure publisher in India. The same record, if analyzed, contained a wealth of data that Lt Royds' figures were correct, including the unexpected support of Captain Amundsen's records.

Dr George Simpson, the *Terra Nova Expedition*'s meteorologist who published the expedition record, had an opportunity, and more importantly the knowledge, to correct the false allegation formulated against Lt Royds. Unfortunately, he did not comment on that issue, and Captain Scott's objections as printed in the second meteorological record volume of the *Discovery Expedition* vanished into the mists of time for coming historians.

Finally, it was Sir William[191] who started the whole turmoil by his ill-conceived thesis that the prevailing winds over the Ross Ice Shelf must be from the east. He lived until 1945 and had ample opportunity to correct his mistake. The American Physical Society, in the Ethics and Values section of its constitution, presents a universal comment:[192] "It should be recognized that honest error is an integral part of the scientific enterprise. It is not unethical to be wrong, provided that errors are promptly acknowledged and corrected when they are detected."

Figure 1.7, reproduced from Dr Simpson's original figures, show a general wind direction on the western side of the Ross Ice Shelf. By looking at pressure distribution over the Barrier, Dr Simpson noticed the presence of high pressure at the base

of the Transantarctic Mountains and decreasing pressure to the east. This alone was a strong sign that despite the presence of Coriolis forces originally driving anticyclones westward, the pressure gradient created by the Transantarctic Mountains and the whole area of the Ross Sea and of the Ross Ice Shelf may be prevailing over the Coriolis forces.

Instead of following historical data and analysis (see for example Drs Lockyer[193] and Simpson), a direct and simple insight into wind direction over the Ross Ice Shelf can be gained from data collected by automated weather stations. I have already used this data to analyze wind events. Now, I will follow with an analysis of wind directions. Table 1.4 summarizes wind directions from several automated weather stations along Lt Royds' party's route as indicated on Figure 1.15.

Table 1.4. Summary of wind directions measured at modern automated weather stations at different locations, as depicted in Figure 1.15. Wind directions were calculated for November and December data, and for the whole data record available at each station in 2011.

Station	S	SE	SW	W	NW	N	NE	E
Gill	22	10	27	13	5	10	4	6
Emilia	22	10	46	9	4	4	3	2
Linda	46	6	6	5	16	6	3	14
Carolyn	23	7	4	4	38	12	4	9
Schwerdtfeger	27	5	21	10	6	26	3	2

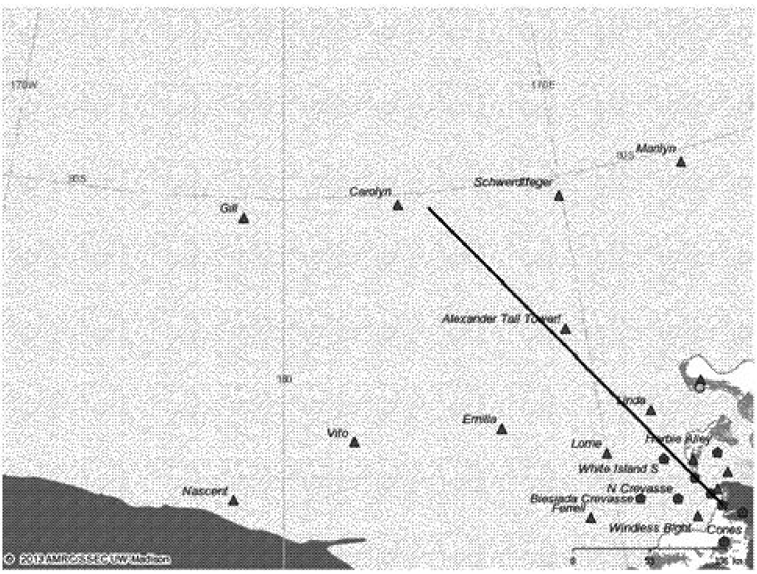


Figure 1.15. An approximate route (black line) of Lt Royds' quest for the eastern shore of the Barrier with its farthest point, 79°35′S, 175°55½′E and automated weather stations as indicated in Table 1.4. Map © 2013 AMRC/SSEC-UM-Madison.

Of course, Table 1.4 presents true wind directions measured at given locations at the Ross Ice Shelf. The directions are given in percent and rounded to the nearest integer. It is rather palpable from this table that the wind directions at this part of the Ross Ice Shelf and for the months of November/December are predominantly South, South-Easterly, and South-Westerly directions. This table also illustrates the expected variations of wind direction dependent upon different locations. Because Lt Royds' party was moving, their mean wind directions as given in the original Table 1.3, are affected by these changes.

Modern wind data, as depicted in Table 1.4, confirms that Lt Charles Royds reported true wind directions. I believe that this is a final and conclusive vindication of both Lt Royds and Captain Scott, who stood by his officer.

We have been waiting almost one hundred years to prove Lt Royds' case. However, one may wonder about Captain Scott's intentions during his *Terra Nova Expedition*. In addition to the South Pole journey, various sledging parties were dispatched by Captain Scott. Thus, he had an opportunity to dispatch a party to investigate wind directions at the Barrier. Certainly, it was impossible during 1911, but in 1912 after the South Pole journey and Antarctic winter ended, an attempt to cross a good portion of the Barrier was possible.

Captain Scott was not shy to use dogs, and Meares was effectively using them for transportation purposes. However, before and during the South Pole journey, Captain Scott showed great concern over the welfare of the dogs. I believe that his instructions resulted from his motivation and undisclosed plans to use dogs the next season to explore the white plains of the Barrier and to collect wind direction data.

1.6. Synopsis

In this opening chapter, I presented a general overview of air circulation at the extremes of the southern hemisphere and over the Antarctic continent. The general pattern of air circulation was described by the introduction of Polar Cells and anticyclonic circulation within these cells. However, the present-day topography of the Antarctic continent, exemplified by the high Antarctic Plateau and particularities of the Ross Sea area, induces precipitation and local cyclonic air circulation over the Ross Ice Shelf. I have also shown that the erratic behavior of wind events is in its intrinsic property a self-organized criticality, described by power-law changes of probability distributions of wind events. Moreover, I have demonstrated that the wind regime over the Antarctic continent tends to be an ergodic system.

These inferences are certainly valid for the present day Antarctic continent, including its topography and location on the Earth's crust. Combined analysis of the spatiotemporal evolution of Antarctica would be interesting and a useful exercise.

Captain Scott, while planning his *Terra Nova Expedition* in 1908, was mercilessly confronted by an establishment related to the Royal Society and Meteorological Office, who under the pretense of science raised false and unfounded arguments against Lt Charles Royds' wind directions record. Despite that, Lt Royds confirmed that the wind directions in his record were true directions[194], and despite no meteorological data to the contrary, the establishment was holding its groundless and unfounded arguments.

Sir Archibald Geikie of the Royal Society and Sir William Napier Shaw of the Meteorological Office had for many years the means and power to scientifically investigate and prove or disprove their allegations. Dr Simpson, who took Sir William's place at the Meteorological Office, had the meteorological data and knowledge to clear Lt Royds' and Captain Scott's names. As a result, the issue propagated into our time, and historians like David Crane then believed and constructed the conjecture that Captain Scott was "pigheaded" over the issue.[195] I have shown that Lt Charles Royds and Captain Scott were correct on their record of true wind directions over the Ross Ice Shelf.

Chapter 2

Analysis of the Weather Account from the *Terra Nova Expedition*

In the Prolegomenon, I already mentioned that I will use in this book in various contexts a *cæteris paribus* assumption. *Cæteris paribus* is a Latin phrase, literally translated as "with other things the same" or "all other things being equal or held constant".[1] The *cæteris paribus* assumption in many different forms was developed and used in finding a general understanding of complex systems, like in biology or economy where simultaneousness analysis of all possible variables is difficult if not impossible. In Chapter 1, while looking at wind behavior in Antarctica and/or a word ranking in polar journals (books), we observed a common feature for these different systems. This common feature was a self-organized criticality of wind behavior and word ranking. The prose of William Shakespeare, Joseph Conrad, and Captain Robert F. Scott in spite of great differences fall under Zipfian law into self-organized criticality. One observes the same property of Polish, French, and other languages. The Zipfian law is a *cæteris paribus* law.

Another example of a *cæteris paribus* law which is closely related to polar exploration may be formulated as: The lack of vitamin C causes scurvy. Experienced physicians or biochemists like Linus Pauling, a great advocate of a very high intake[2] of vitamin C, would only say that this law is merely possible and not universal, like the laws of physics.

By the same token, I can formulate a *cæteris paribus* assumption: humans can reach and return from the South Pole. It was Lt Shackleton who on Jan. 9th, 1909 turned back only 97.5 miles (181 km) from the Pole.[3]

As far as the Captain Amundsen and Captain Scott expeditions and reaching the South Pole were concerned, my *cæteris paribus* assumption is that, in spite of different methods, means, and human effort, both expeditions were able to reach the South Pole, and both teams were capable of returning safely to the base camp at Framheim and Cape Evans (Hut Point), respectively.

This leaves the weather, understood as a combination of temperature and wind speed, as the only *independent* variable. In the following chapters, I will investigate questions related to weather conditions during Captain Scott's *Terra Nova Expedition*.

2.1. Captain Scott's Journals

Captain Scott's journals are not only descriptive field reports, but also reflections on their author's literary style. These journals,[4] especially the one written during the

Terra Nova Expedition, are in contrast from the similar journals of Lt Shackleton,[5] and especially Captain Amundsen, whose dull but occasionally fine literary style vividly contrasts with his exploration achievements.

Captain Scott used two types of notebooks. At Cape Evans and on board the *Terra Nova*, he used large quarto MS books, as depicted on one of the most frequently published pictures (Fig. 2.1) taken by the expedition's camera artist – Herbert Ponting. The second type of notepad was much smaller; it was the so-called artist's notebook containing 96 pages with a rounded right-hand top and bottom corners. These small notebooks were used during three man-hauling sledge journeys: One Ton Depôt Journey (Jan. 26th through Mar. 23rd, 1911), Spring Journey to Corner Camp (Sep. 9th through 15th, 1911), and the Polar Journey (Nov. 3rd, 1911 through Mar. 29th, 1912). Captain Scott's journals written during the South Pole attempt were found by the search party on Nov. 12th, 1912. "Inside the front cover of the No.3 [Journal – KS] are the following words: 'Diary can be read by finder to ensure recording of Records, &c., but Diary should be sent to my widow.' And on the first page: 'Send this diary to my widow. 'R. SCOTT.' The word 'wife' had been struck out and replaced by 'widow'."[6] Captain Scott's wish was fulfilled, and all of his journals were delivered to Kathleen Scott.

Figure 2.1. Captain Scott writing his expedition journal in his cubby-hole at Cape Evans in the Antarctic winter of 1911.[1] © Alexander Turnbull Library, Wellington, New Zealand

[1] One hundred years later, David Attenborough in Captain Scott's hut http://www.bbc.co.uk/news/magazine-15536157

For Captain Scott, the weather was bad, bright, calm, clear, cold, coldest, decent, dirty, fair, favorable, fine, frostbiting, heaviest, mysterious, splendid, sunshiny, terrible, thick, though, unequal, and warm. For Captain Amundsen, the weather was awful, bad, calm, clear, delightful, fair, fine, glorious, lovely, manageable, nasty, nice, splendid, and thick – but most of the time just *the* weather. In the previous chapter,

I have shown on Figs. 1.9 and 1.10 that Captain Scott's narrative on both the *Discovery* and *Terra Nova Expeditions* followed Zipf's law. Their plot, however, hides interesting similarities and differences between various expeditions. A better insight, but not in the form of a literary analysis, can be gained by ranking the frequency of certain words. A snapshot of such analysis is presented in Tab. 2.1. The second column in this table gives a true rank of words found in English texts obtained from a great number of books. Thus, it represents a rank of given words in English, and it may serve as a reference.

Table 2.1. Ranking of word usage count in English[1] language texts and principal narratives of Antarctic[2] expeditions.

Word	English	Discovery	Terra Nova	Amundsen	Nimrod	Mawson
Arctic	8663	8432	25714	10591	8500	17571
Blizzard	5891	6000	1277	10591	1581	3000
Breeze	5809	8000	4286	3329	4533	6833
Clouds	14414	6782	4736	16642	5037	3324
Cold	502	2600	1052	2262	1971	2320
Gale	6530	3804	3050	7061	4387	8200
Hurricane	1250	312000	90000	no rank	27200	4656
Sastrugi	no rank	12000	3051	16642	3091	2617
Scurvy	5536	6500	36000	25889	27200	61500
Snow	719	535	534	602	397	321
Storm	2520	82100	6000	6297	19429	20500
Sun	275	1762	1154	2262	1915	1500
Surface	8938	1013	582	1022	795	778
Temperature	5560	2437	933	1137	729	1708
Warm	2697	5672	2069	2648	3163	4100
Weather	855	1399	865	860	735	866
Wind	1755	792	326	967	648	275

1 http://www.wordcount.org/querycount.php; *Wordcount* data currently comes from the British National Corpus®, a 100 million word collection of samples of written and spoken language from a wide range of sources, designed to represent an accurate cross-section of current English usage.

2 Robert F. Scott, *The Voyage of Discovery*, MacMillan & Co., London, 1905; Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R. F. Scott, R. N., C. V. O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913; Roald Amundsen, *The South Pole: An Account of the Norwegian Antarctic Expedition in the „Fram," 1910–1912*, John Murray, London, 1912; Ernest Shackleton, *The Heart of the Antarctic: Being the Story of the British Antarctic Expedition 1907–1909*, W. Heinemann, 1909; Douglas Mawson, *The Home of the Blizzard: Being the Story of the Australasian Antarctic Expedition, 1911–1913*, W. Heinemann, London, 1915.

Just by looking at the figures in Tab. 2.1, one with knowing nothing about expeditions and calling them Expedition A, B, … ,E certainly could say the following:

1. Expeditions A, B, … ,E travelled in windy places,
2. With little sunshine and clouds frequently covering the sky,
3. The surface on which they travelled was a significant nuisance factor in the mode of travelling,
4. There were no health problems related to scurvy,
5. The temperature was an issue for the expeditions, but it is not clear whether it was a high or low-temperature issue.

The above suggestions of observations drawn from Tab. 2.1 are indeed very general, and may not be sufficiently useful. However, by adding additional word clustering ranking, one may gain a more subtle insight into each expedition's actual performance related to meteorology.

By comparing the narratives of Captain Scott's expeditions, it is easy to notice that the *Terra Nova Expedition* was battered by blizzards and low temperatures, while Captain Amundsen was travelling in moderate conditions. For example, the word blizzard has a frequency rank of 5891 in common English, which indicates that this particular word is rarely used. A similar rank for blizzard (6000) was found in Captain Scott's *Discovery Expedition*. A dramatic shift in the blizzard word ranking is observed during the *Terra Nova Expedition*, and the rank is about 1277, which is more than twice that of the rank for blizzard in Douglas Mawson's *The Home of the Blizzard*. These rank differences are telling. However, one should not conclude that Captain Scott's *Terra Nova Expedition* was in an exceptional way battered by endless blizzards. In the following chapters, I will show that it was not the case.

2.2. Leonard Huxley's Adjustment of the First Edition of Captain Scott's Journals

It was Leonard Huxley[7] who acted as the Editor and arranged the first edition of Captain Scott's journals.[8] During editorial work, Huxley consulted members of the expedition, but it was chiefly Cherry-Garrard who worked as the main consultant on added notes.[9] The role of Kathleen Scott, Sir Clements Markham, and James M. Barrie in getting the journals published was indispensable. Captain Scott's wife kept the original journals, Sir Clements kept troublemakers at bay, and Barrie kept social relationships. The first edition was published in London by Smith Elder, and in the US by Dodd, Mead, and Co. in 1913.

To make his case, Dr Max Jones in 2003 perceived "it is now commonly believed that an establishment conspiracy covered up Scott's failings, creating a hero by the careful editing of his sledging journals. 'For publication,' wrote the polar historian Roland Huntford, the principal proponent of the conspiracy theory, 'his diaries were purged of all passages detracting from a perfect image'. 'The aim was to prettify Scott's image, conceal blunders and project the myth of a perfect martyred hero.'"[10] Three years later, Dr Jones presented an annotated new edition of Captain Scott's journals, together with his comparative analysis of the original journals with their first book edition. It was a continuation of his work from 2003, which stated that "systematic

comparison of the published journal with Scott's original exposes relative conventions of popular biography, not an establishment conspiracy."[11] One of these changes was concerned with discrepancies between temperature entries in Captain Scott's journal and their first edition. Dr Jones suggested in 2006 that "The arbitrary nature of the changes [temperature – KS] suggests they may even have been genuine typographical errors."[12] However, Dr Jones' observation is highly questionable. Not least because he conceals and downplays the extent and purpose of the changes by stating "Thirteen of these were reduced, exaggerating the severity of the conditions faced. Yet the rationale behind the changes is confusing."[13]

During the *Terra Nova Expedition*, Captain Scott did not record temperatures or other meteorological parameters in any systematic way, as it was not his duty. According to Dr Jones'[14] count, in the period from Oct. 18th, 1910 through Mar.

Table 2.2. Original temperature recordings from Captain Scott's journal, including changed values were published in the first edition of the journal with Dr Simpson's temperature data taken from Lt Bowers' log. All temperatures are given in °F.

Date	Scott's entry[1]	Change to[2]	Simpson Data[3]	Huntford[4]
Nov. 3rd/1911	+22	–22	5.3, 20.3, 2,7	+22
Nov. 7th	+10	–10	1.7, 9, 10.6, 7.7	+12
9 Nov.9th	+12	–12	11.5, 13.1, 1.7, 0.5	–
Nov. 12th	+10	–10	8.6, 12.1, 10.3, 7.4	+10
Nov. 13th	+10	–10	5, 15.5, 5.6, 2.2	–10
Nov. 25th	+2	–2	–9, 0.6	–8, +2
Dec. 17th	+12	–12	12.0, 11.3, 13.5,	–12
Dec. 18th	+11	–11	13.3, 12.6, 10.5	–11
Dec. 19th	+11, +5	–11, –5	9.2, 14, 10.8	+11, +5
Dec. 28th	–6	no entry	–11.1, –7, –6	–6
Feb. 11th/1912	+6.5, +3.5	–6.5, –3.5	0.7, 6.0, 3.0	–6.5, –3.5
Feb. 13th	+10	–10	6.0, 8.9, 9.7	+10
Feb. 14th	0, +1	0, –1	7.4, 6.6, 0.8	0, +1
Feb. 15th	+4, +10	–4, –10	1.9, 10.4, 3.5	–10, –4
Feb. 16th	+6.1, +7	–6.1, –7	5.9, 5.6, 6.5	–6.1, +7
Feb. 21st	+9.5, –11	–9.5, –11	–21.7, –10.2, –20.4	–12, –20

1 Max Jones (Ed.), *Journals: Captain Scott's Last Expedition*, Oxford University Press, Oxford, 2006.
2 Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R. F. Scott, R. N., C. V .O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913.
3 George C. Simpson, *Meteorology*, Vol. III, *Tables*, Harrison and Sons, Ltd., London, 1923.
4 Roland Huntford, *Race for the South Pole: The Expedition Diaries of Scott and Amundsen*, Continuum, London, 2010.

29th, 1912, there were over 175 temperature entries by Captain Scott. Out of these temperature records present in Captain Scott's published journal, 20 readings in the first edition were changed from + °F to – °F. See Tab. 2.2.[15] If these 20 records were *genuine typographical errors* as suggested by Dr Jones, then one should observe the random distribution of 20 changes in value and time. None of this, however, is observed.

If the value changes were random, one would expect their average value to be ±0°F. In here, I am speaking about the change of temperature *sign* from plus to minus or the opposite, which is a change of the *binary* signal of a statistically uncorrelated sequence. In such a case, the white noise is a mean equal to zero.[16]

However, on average (for *each* temperature entry) the temperature was *lowered* by about –17°F. This figure is contrary to Dr Jones' ruling that "The reduction of temperatures exaggerated the difficulties faced by the explorers, although the rationale behind the changes is unclear, as most were so small as to be of little significance."[17] Lowering the average temperature record by about –17°F is not "of little significance". It is data dragging and manipulation, one of the most severe forms of scientific misconduct.

Examining the randomness of frequency change leads us to the same conclusion. Out of these changes, only 4 changes were made in {Apr. 25th – May 31st}, and the remaining 20 changes were from {Nov. 7th – Feb. 21st}. That is, about 83% of all temperature changes were made during the Polar Journey. Clearly not a random (in time) distribution.

Finally, Dr Jones claimed in 2003 that "on at least one occasion (19 December 1911) the temperature published was actually increased."[18] This claim went down the Orwellian memory hole three years later, as he showed the temperatures for this day being decreased.[19]

I believe that the above simple analysis shows in a clear way that the temperature changes made in the first edition of Captain Scott's journals were not random (in time and value), and were not "genuine" typographical errors but deliberate changes introduced to dramatize weather conditions encountered by the South Pole Party. It is interesting at this moment to notice that after the date of Feb. 25th, 1912, no changes of temperature entries in Captain Scott's journal were made. Two days later, on Feb. 27th, 1912, Captain Scott reported an unprecedented cold snap which lasted for three weeks. I will address all pertinent questions in relation to this rare, *black swan* event[20] in Chapter 7.

The third and the last volume of the *Terra Nova Expedition*, 1910–1913, titled *Meteorology* and sub-titled *Tables* was, contrary to Dr Simpson's previous volumes, published in London by Harrison and Sons. Although the publication date is indicated on the front page as 1923, I presume because Dr Simpson's introduction to the volume is dated London, February 1924, that the work was printed and sold by Harrison and Sons, Ltd., after that last date. "With very few exceptions this volume contains a record of every meteorological observation taken on Captain Scott's last expedition from the time the *Terra Nova* left New Zealand on November 30th, 1910, to the time she returned on February 12th, 1913."[21] In the next chapter, I will critically re-examine Dr Simpson's analysis of Captain Scott's meteorological record.

The volume, in addition to supplementary pages like introduction and index, contains 821 pages filled with meteorological data. While working on meteorological issues related to Captain Scott, I have relied on the data gathered in this volume. On

a number of occasions, I have spotted here and there some incorrect entries. However, these were just marginal and inevitable slips while handling (without a computer) such a vast amount of data. Dr Simpson acknowledged the help of a meteorologist named Arthur H. Bell and used data from "the original records and the papers" which "are stored in the library of the Meteorological Office, South Kensington, London, where they may be examined by permission of the Director."[22]

The first edition of Captain Scott's journals was published in 1913 by Smith Elder, London, and contained the above mentioned deliberately lowered temperature entries. A new edition and new print were prepared by John Murray in 1923, who at about the same time purchased the bankrupt Smith Elder. If one was willing it was an occasion to revise the Captain Scott journal's wording and entries. Apparently, at that time Emily Shackleton approached John Murray with a suggestion that Kathleen Scott agreed that Captain Scott's passage criticizing her late husband was to be altered.[23] Kathleen was guarding her husband's journal, and thanks to her the first edition of the journal did not contain passage(s) criticizing Lt Shackleton. How then or from whom did Emily learn about the unspecified line of criticism? There were two people involved: Kathleen and John Murray. Apparently Kathleen, in response to Emily Shackleton's request, informed Murray that "my impression is that it would be a mistake to alter anything at all. Everything was very carefully gone into by Mr. Reginald Smith & Mr. Leonard Huxley & me at the time." Without permission, Murray could not do otherwise and Captain Scott's passage "I imagine he [Shackleton] confused hock & fetlock or wilfully exaggerated" in connection with events dated by Captain Scott on Nov. 8th, 1911 did not appear in the 1923 edition. How Lady Shackleton learned about the passage remains open, but based on his knowledge of Captain Scott's journal (see subsection 11.1.13), I suspect his former second in command Captain Evans had something to do with it.

Poor Lt Shackleton's widow was not a partner to discuss the matter with. But Dr Simpson was. The real worry was that Dr Simpson's meteorology treatise with meteorological tables was about to be printed in late 1923 or early 1924. The volume contained the full temperature records of the expedition, and on pages 618–643, in *Table 72, the Register of the Main Polar Party November 3rd, 1911, to March 12th, 1912* was presented. This table was a reproduction (collection) of the meteorological records of Lt Bowers, who was responsible for keeping it. There was no record of temperatures from Captain Scott's journal, as his entries were regarded as not an official record but rather casual entries. For a curious reader, as I will show later, Table 72 could give a wealth of information. I have shown in Tab. 2.2. the respective temperature entries from the original Captain Scott journal, the first edition of the published journal, and Dr Simpson's meteorology book, Vol. III. The three temperature entries from Lt Bowers' log represent his temperature recordings in the morning, afternoon and evening.

Look at the temperature records for Dec. 17th, 1911 in the Tab. 2.2. Lt Bowers' averaged recordings for this day were +12.3°F, whereas Captain Scott's temperature entry printed in the first edition of the journal was changed to –12°F. A similar pattern is observed for the remaining entries. Since Lt Bowers was taking his reading at least three times a day, the cautious reader would naturally have more trust in them than the singular and not consistent temperature entries recorded by Captain Scott. There was no choice on the editorial side, and John Murray was indirectly forced by the

expected publication of Dr Simpson's last volume to change the temperature records altered by Huxley to exaggerate weather conditions. Although Huxley's involvement in the editorial work of the first edition is well known, it is not clear whether at all he was involved in the subsequent 1923 John Murray edition. But then the question arises: on what basis and using whose material were the changes introduced in the 1923 edition? Did John Murray have access to the original journal held by Kathleen Scott? Or was he presented with a list of corrections in the first edition? No clear answer has yet been established. Sadly, the incorrect temperature entries from the first edition found their way into future editions, including the last one published by Oxford University Press under Dr Max Jones' editorial supervision.[24]

It should not escape one's attention that Leonard Huxley's deliberate change of temperature records in Captain Scott's journal was done to *exaggerate* and thus *dramatize* the weather conditions.

In Tab. 2.2, besides Captain Scott's original temperature data, I have added the respective entries[25] taken from the recently published original journal of Captain Scott along with the diary of Olav Bjaaland, who accompanied Captain Amundsen. One can easily notice the differences between temperatures apparently taken from the editions of Captain Scott's journals by Huntford and Dr Jones.

There is one more piece of evidence that the editor of Captain Scott journals, Leonard Huxley, really edited the first publication. During the second part of March 1912, Captain Scott was writing farewell letters to his backers, supporters, and family. Clearly, these letters were not an integral part of the Captain Scott journals. Nevertheless, Leonard Huxley chose to include these in the printing of the first edition of the journals, which included seven letters, including Captain Scott's letters to Mrs Wilson and Mrs Bowers.

Figure 2.2. Captain Robert F. Scott and Kathleen Scott. © Alexander Turnbull Library, Wellington, New Zealand.

In the case of the remaining letters, Huxley without giving a reason decided differently[26]

> Letters to his Mother, his Wife, his Brother-in-law (Sir William Ellison Macartney), Admiral Sir Lewis Beaumont, and Mr. and Mrs Reginald Smith were also found, from which come the following extracts:

The printed extracts, however, did not comprise vital, from our and I presume the readers point of view, information. This vital information was in this Captain Scott line from a letter to his wife Kathleen,[27]

> Dear it is not easy to write because of the cold –70 degrees below zero [*sic*] and nothing but the shelter of our tent

Captain Scott's temperature of –70°F speaks for itself as a gross exaggeration. At another instance, and this time in the letter to Vice-Admiral Sir Francis Charles Bridgeman, Captain Scott gives an additional grotesque exaggeration "Excuse writing it is – 40, and has been for nigh a month [*sic*]."[28]

2.3. Expedition Member's Accounts and Descriptions

Who but the members of the expedition could speak about the weather and its impact on Captain Scott and his South Pole journey? Captain Edward Ratcliffe Garth Russell "Teddy" Evans, who as a Lieutenant was second in command of the *Terra Nova Expedition*, in his account *South with Scott*[29] naturally reflected upon the two attempts of rescue parties dispatched from Cape Evans in March 1912. In chapter XVII, titled *The Second Winter – Finding of the Polar Party*, Captain Evans comments on the First Relief Party, Feb. 26th through Mar. 16th, 1912 led by Cherry-Garrard and the Second Relief Party, Mar. 27th through Apr. 1st, 1912 led by Dr Atkinson.

The First Relief Party, Apsley Cherry-Garrard and Dmitrii Girev [*sic*], was dispatched by Dr Edward L. Atkinson from Cape Evans on Feb. 26th and returned to the base camp on Mar. 16th, 1912. Very little is known about Captain Scott's dog driver, Dmitrii Girev; in fact, I have yet to see a *Terra Nova Expedition* book author who even knows the proper spelling of his name, though some other authors who refer to the expedition in passing have nearly gotten his name right. Captain Scott writes his name as "Demetri Gerof". However, research by Vicheslav I. Yuzefov[30] has shown that the proper spelling should be Dmitrii Semenovich Girev (Дмитрий Семенович Гирев), though his translator gets his middle name wrong. The Russian Wikipedia[31], which being staffed by native Russian speakers is far more reliable than a translator, gives the spelling Дмитрий Семёнович Гирев (Dmitrii Semyonovich Girev). Therefore, throughout this book I will retain the correct spelling of Dmitrii Girev, instead of the incorrect previous spelling "Demetri Gerof". The party arrived at One Ton Depôt in the late afternoon of Mar. 3rd by means of dog sledging. They camped there until the morning of Mar. 10th. Captain Evans described the First Relief Party[32]

> Cherry-Garrard and Dimitri [Dmitrii] had a tough time of it. They, however, reached One Ton Camp on March, and were held there by blizzard weather, which made travelling impossible. Temperatures of 40 degrees below zero and lower [*sic*] were experienced.

Table 2.3. The Register of the First Relief (Dog Sledge) Party.[1] The temperature is given in °F and wind force in the Beaufort scale.

Date	Time	Dry Bulb Temperature [°F]	Wind Force	Remarks
Mar. 2nd	14	–14.7	2	
	18:15	–21.5	1–2	
Mar. 3rd	9	–23.7	–	
	13:45	–14.5	–	
	17:45	–24.5	1	
Mar. 4th	9	–	6	Blizzard at night, now much better
	16:45	–8.5	4–5	Still blowing
	20:45	–15.0	5	
Mar. 5th	9	–18.5	1	
	14	–21.0	–	
	20	–34	–	
Mar. 6th	9:30	14.5	7–8	Blizzard started at night
	17:30	–6.5	3	
	20	–19.5	1	
Mar. 7th	12:30	–8.5	1	Blizzard blew in the night
	16:15	–10.5	1	
	20:30	–27.5	1	
Mar. 8th	9	–28.0	3	
	15:30	–23.0	–	
	20	–37.0	–	
Mar. 9th	9	–13.5	6	Blizzard
	15:45	–14.4	2–3	Drift
	20	–27.0	2	
Mar. 10th	8	–33.5	1–2	
	13:45	–23.0	–	
	19	–16.5	2	

[1] George C. Simpson, *Meteorology*, Vol. III, *Tables*, Harrison and Sons, Ltd., London, 1923, *cf.* p. 676.

In Tab. 2.3, I have shown the respective temperature and wind velocity records of Cherry-Garrard recorded at One Ton Depôt. At first glance, from this table one can see that *at no occasion* did this party experience –40°F or lower, as Captain Evans excessively suggests. On the contrary, the average lowest temperature recorded was

circa –21°F and –27°F between Mar. 3rd and 10th, when the party was at One Ton Depôt. Differences between the actual temperatures and Captain Evans' "–40°F and lower temperatures" are readily noticeable.

In the above description, Captain Evans also comments that the party was held at One Ton Depôt by blizzard weather, and he makes the conjecture that the blizzard "made travelling impossible". Let us look more closely at this issue.

In the same Tab. 2.3, I have depicted the wind force estimated by Cherry-Garrard and accompanied with the remarks of Dr Simpson taken from his meteorology summary. It is surprising how easily Captain Evans, who almost reached the South Pole but was turned back by Captain Scott on Jan. 4th, 1912, makes a hyperbole of the weather conditions faced by the small Cherry-Garrard party. Captain Evans knew very well what an Antarctic blizzard is. His field experience was more than satisfactory. He knew that blizzards may last a few days, like the one which struck the whole Captain Scott party at the foot of the Beardmore Glacier on Dec. 5th, 1911 and lasted for four days and nights.[33] But he also knew that blizzards may be short lived, like for example the one encountered by his Second Return Party on Jan. 9th, 1912, which lasted for less than 24 hours.[34] Later in this book, I will analyze with minute detail blizzard events in Antarctica, and their relation to blizzards encountered by Captain Scott, especially the 9/10-day blizzard in late March 1912. Here in relation to Captain Evans' description, one can fairly assume that at a wind speed about or greater than 6 in the Beaufort wind force scale, strong breeze (10.8–13.6 m/s (25–30 mph)), one can expect that blizzard conditions would commence. Comparing wind speed data presented in Tab. 2.3, one can see that Cherry-Garrard while camped at One Ton Depôt faced four *short-lived* blizzard events.

A blizzard event is a combination of wind and gravity of surface snow. We do not know the real field conditions during this time, and we can only make educated guesses from the meteorological field data. From the Tab. 2.3, it appears that the blizzards were *not* severe, and more importantly short-lived. I believe they could not be used as an excuse for Cherry-Garrard not going south from One Ton Depôt as presented in Captain Evans' account. Certainly there was no blizzard weather but rather four blizzard events, which could only force temporary tent pitching. It appears that the false and mysterious notion of a *four*-day blizzard encountered at One Ton Depôt served to some authors like Wheeler,[35] Huxley,[36] and Huntford[37] as an excuse for Cherry-Garrard's decisions on what to do after arrival. Likely, that invented blizzard and the exaggerated temperatures of "40 degrees below zero and lower" were the excuses he used to dupe Captain Evans.

There is no need to invent a four-day blizzard to explain Cherry-Garrard's motives. Dr Atkinson's instructions to make his own judgment upon arrival given to Cherry-Garrard were unusual by Navy standards. One Ton Depôt is about 130 geographical miles *from* Cape Evans [*sic*], and with Dmitrii's skills of dog sledging they needed 7 days to reach it. Thus, it gives a fine velocity of about 18.6 miles per day on the outward trip.

In the second volume of the *Terra Nova Expedition*, containing the reports of the journeys and the scientific work undertaken, expedition surgeon Dr E. L. Atkinson, R.N., who was in charge at Cape Evans described the aim to dispatch "the dog teams [which] were meant merely to hasten the return of the Southern Party and by no means as a relief expedition" in the chapter titled *The Attempt to Meet the Polar Party*.[38] Moreover, he described the logistic aspects of the First Relief Party[39]

> After due consideration of weights and the probabilities of the date by which the final party could return to certain depots, it was decided that the dogs should take 24 days' food for themselves and 21 days' food for the two men, carrying in addition two weeks' surplus supplies for the Southern Party complete and certain delicacies which they had asked for. The totals brought the weight carried by each team up to the most economical travelling limit for the time of year. As there was no dog food in any of the depots except at Corner Camp or along any of the route, it meant that, counting in this supply, 24 days was the limit of their usefulness.

Dr Atkinson's description is indeed unclear and cursorily formulated. The most puzzling is Dr Atkinson's invention of the weight of carried supplies up to "the most economical travelling limit for this time of year". The time was the end of February, and no one before or long after was dog sledging in this month in Antarctica. How then did Dr Atkinson, who additionally did not have experience and knowledge of dog sledging, figure out the special weight limit for this particular time of the year? Why did Dr Atkinson not consult Cecil Meares,[40] who was in charge of the dogs? Or even better, why did he not consult the best source of knowledge related to dog sledging, Dmitrii Girev, the dog driver?

It is likely that by saying "the most economical" Dr Atkinson meant to dog sledge as far as possible with the overall weight as small as possible. However, if one carefully looks at dog sledging, it is apparent that without a laying depôt and/or without using dogs to feed dogs and/or starving man and dog, the issue of optimization is nonessential and needless. For travel over one day, one needs one food ration for man and one for the dog. In such a case, the dog sledge distance is simply limited by initial (at start) weight of food and gear. Provided that a man is using his own power to travel, there is a maximum initial weight of food and gear to be dog sledged. This initial weight is related to the sustainable pulling power of a dog. This subject, so casually mentioned by Dr Atkinson, was actually *the most important issue* of polar exploration.

In short, to recapitulate Dr Atkinson's description of the First Relief Party, the party of Cherry-Garrard and Girev carried 24 dog rations and 21 man rations for each dog and man, respectively. Thus, the party could comfortably travel for a full 21 days.[41]

Let me now briefly discuss what Dr Atkinson and/or Cherry-Garrard could know about Captain Scott's party at the end of February 1912. Captain Scott's plan was a 144 days round trip (~1456 miles) to the South Pole, which gives a velocity of ~10.1 miles per day. As a matter of fact, if the round trip was completed, the actual distance (see Fig. 2.3) calculated from Captain Scott's filed data would give $\sim 2 \times 749 = 1498$ geographical miles. Captain Scott started his South Pole journey from Hut Point (–77.783333)[42] on Nov. 3rd, 1911. One can easily calculate that he and his party after travelling for 130 days should arrive at One Ton Depôt (–79.475) on or about Mar. 11th, 1912. However, in reality it was known from the Second Return Party that on Jan. 4th 1912 the Captain Scott party was at least about 5 days behind the schedule. This means that Cherry-Garrard would expect Captain Scott's party to arrive at One Ton Depôt on or about Mar. 16th. Therefore, Cherry-Garrard could think that upon his arrival at the depôt, Captain Scott was about 13 days of travelling away – that

is, about 131 miles. According to these theoretical calculations possibly made by Dr Atkinson and Cherry-Garrard, Captain Scott was at –82.1.

However, at the same moment Cherry-Garrard and Dr Atkinson could also calculate from the First and the Second Return Parties, timing the lower time-bound limit for Captain Scott's return. The parties returned with greater velocities than originally assumed by Captain Scott, and achieved on average 13 miles/day and 13.2 miles/day, respectively. These velocities give possible return dates of Mar. 4th and Mar. 3rd.

Taking into account the above estimations, Cherry-Garrard and Dr Atkinson could reasonably expect the Captain Scott party at One Ton Depôt somewhere between the dates of Feb. 28th through Mar. 13th, 1912.

Scenario 1 – Captain Scott's Arrival at One Ton Depôt

$$\frac{728[\text{miles}]}{\upsilon_0[\text{miles / day}]}+\frac{(728-118)[\text{miles}]}{\upsilon_0 \text{ or } \upsilon_1 \text{ or } \upsilon_2[\text{miles / day}]}=\text{Number of sledging days}[\text{days}]$$

1. March ~13th with $\upsilon_0 = 10.1$ m/d
2. February ~28th with $\upsilon_0 = 10.1$ m/d and $\upsilon_1 = 13.2$ m/d
3. February ~29th with $\upsilon_0 = 10.1$ m/d and $\upsilon_2 = 13$ m/d

Scenario 1 above was (if) calculated (estimated) by Dr Atkinson and Cherry-Garrard by assuming the original Captain Scott plan of 144-days and the distance of ~2 × 728 = 1456 miles. However, after the return of the Second Return Party, the distance covered was updated with actual expedition positions,[43] and it would mean that an extra 42 miles must be added into a new Captain Scott return scenario. Thus, Dr Atkinson and Cherry-Garrard could recalculate the expected arrival time.

Scenario 2 – Captain Scott's Arrival at One Ton Depôt

$$\frac{749[\text{miles}]}{\upsilon_0[\text{miles / day}]}+\frac{(749-118)[\text{miles}]}{\upsilon_0 \text{ or } \upsilon_1 \text{ or } \upsilon_2[\text{miles / day}]}=\text{Number of sledging days}[\text{days}]$$

1. March ~18th with $\upsilon_0 = 10.1$ m/d
2. March ~3rd with $\upsilon_0 = 10.1$ m/d and $\upsilon_1 = 13.2$ m/d
3. March ~4th with $\upsilon_0 = 10.1$ m/d and $\upsilon_2 = 13$ m/d

Cherry-Garrard never[44] described his thinking at One Ton Depôt in terms of numbers. Instead, he commented[45]

> Since there was no depôt of dog-food at One Ton it was not possible to go farther South (except for the one day mentioned above) without killing dogs. My orders on this point were perfectly explicit; I saw no reason for disobeying them, and indeed it appeared that we had been wrong to hurry out so soon, before the time that Scott had reckoned that he would return, and that the Polar Party would really come in at the time Scott had calculated before starting rather than at the time we had reckoned from the data brought back by the Last Return Party

From the above, it may appear that Cherry-Garrard, and of course Dr Atkinson, recalculated Captain Scott's travelling schedule, and I suppose that they arrived at figures similar to those given by me in the above. However, what is baffling in Cherry--Garrard's above citation is his false conjuncture between the lack of dog food at the depôt and thus his failure and incapacity to go farther South. The Cherry-Garrard biographer Sara Wheeler, without the slightest reflection and analysis, continues along Cherry-Garrard's lines[46]

> Although others did the re-provisioning, and man food was laid at One Ton, in the confusion and comings and goings of parties and the ship, dog food had been forgotten.

Cherry-Garrard's food rations, taken from Hut Point, were limited and diminished every day. But he had taken, as Dr Atkinson clearly confirmed, 24 dogs and 21 man daily rations, and his statement about the lack of dog food and thus inability to go South and search for Captain Scott's party is not true. There was not only a theoretical but, as we learned later after reading Captain Scott's journals, a real window of opportunity that the First Relief Party under the command of Apsley Cherry-Garrard would save or at least attempt to save the Main Polar Party. The logic behind this startling conclusion is indeed simple.

In the above, I have calculated two Scenarios of Captain Scott's arrival at One Ton Depôt. Let us continue with Scenario 2, which is the scenario with distances updated by returning parties. Within Scenario 2, let us pick up the worst case, case 3, which assumes that the Captain Scott party, contrary to the two returning parties, did not move faster than the original velocity of 10.1 miles per day.

Within this scenario, the point of no return for Cherry-Garrard is marked by March 6½, 1912, which translates to a geographical location of –81.48 on this particular day/night. If Cherry-Garrard or Dr Atkinson calculated the theoretical position of the Captain Scott party then they would get –81.35! Both parties would meet on Mar. 5th, 1912 at about –81.30.

This simple calculation shows that there was a deep reason for Cherry-Garrard to push South. One, at this moment, could argue that the presented theoretical calculation, which not only I was able to make but also Dr Atkinson and Cherry-Garrard should make, do not take into account meteorological events which could prohibit travelling. However, the influence of the weather on polar travel is a delusion shared by many people interested in polar history. To support this notion, I have calculated the daily distances travelled by Captain Scott's Party and the two Return parties during the *Terra Nova Expedition*. The results are depicted in Fig. 2.3. Along the points indicating daily progress, I have shown average velocity calculated by linear least squares fit to the

in situ data. Provided that the fitting procedure was used during clearly visible periods of steady velocity, the procedure gives a very nice linear fit, confirming *steady* velocity during prolonged periods despite occasional blizzard events. For example, on the outward routes to the South Pole, one observes two steady velocity regions in $\upsilon_1 = 10.9$ miles/day and $\upsilon_2 = 10.6$ miles/day. These two steady velocity regions are separated by well-known blizzard events (Dec. 5th through 8th, 1912) at the foot of Beardmore Glacier. Besides this particular blizzard, Captain Scott makes more than twenty references to blizzard events during his journey toward the Pole. A similar conclusion is also valid for the First and the Second Return Parties. See Fig. 2.3.

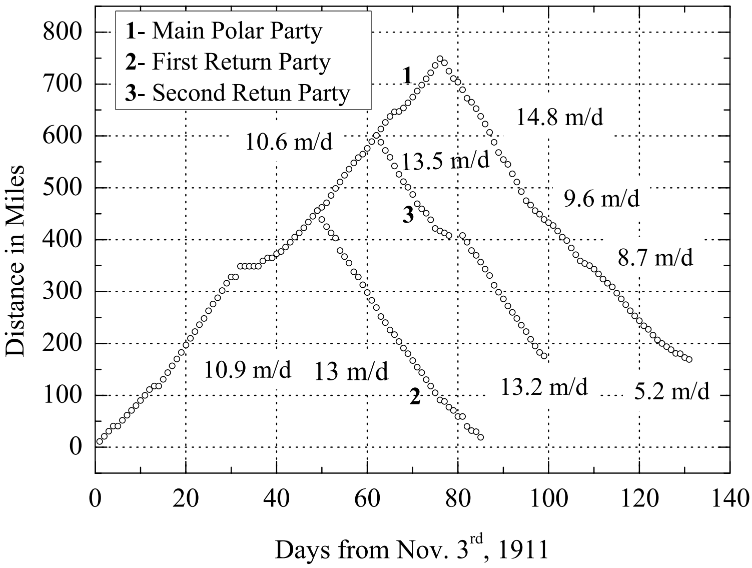


Figure 2.3. The plot of distance travelled since Nov. 3rd, 1911 by Main Polar Party (**1**), First (**2**) and Second Return (**3**) Parties, respectively. Approximate daily velocities are depicted on this figure in miles (geographical)/day.

The above estimations of travelling distance and the possible meeting of the Main Polar party with the First Relief Party were based on the worst case in Scenario 2. However, with knowledge attained after the event, one can ask what would be the date and position of both parties meeting if Cherry-Garrard proceeded as described in Scenario 2 – that is if he has moved on beyond the One Ton Depôt. The calculations are simple, and one would get a meeting date of Mar. 7th, 1912 when both parties reached –80.97 (Scott) and –80.98 (Cherry-Garrard).

Therefore, regardless of the Scenario 2 or the real data, both parties would meet at or on Mar. 7th, 1912.

None of that happened. Cherry-Garrard stayed at One Ton Depôt and waited. Waited for what? Sara Wheeler accounts for this by saying " Both Atch [Dr Atkinson] and Cherry thought the dog party was going out to meet Scott at One Ton and help him get back …"[47], Preston suggests "He wondered whether he would find Scott already there …"[48] and Huxley hints that "He and Dimitri [Dmitrii] reached the depot

in eight days, on 3 March, and were relieved [*sic*] to find that the polar party had not yet arrived, so that their supplies would be in time".[49]

For the investigative reader, these three comments made by Sarah Wheeler, Diana Preston, and Elspeth Huxley are amateurish and true to Captain Scott's characteristic conviction that "the things" somehow will find their proper place through improvisation. These comments live on their own, as if there is no concept of velocity, distance, and time.

These comments are in clear contrast with the above analysis and conclusions. So why was Cherry-Garrard waiting at One Ton Depôt? Clearly he had a surplus of food for himself and the dogs. During his stay at One Ton Depôt he, Dmitrii, and the dogs were fed. Moreover, Dr Atkinson who was in charge during Captain Scott's absence had *carte blanche* to order Cherry-Garrard to use his own judgment as to what to do upon his arrival at One Ton Depôt. Huxley explains, "the matter was settled for him by a blizzard which blew for four days. When stopped, his dog food was sufficient for only two more days at the depot, allowing one week for the return. He could have gone south for one more day, fifteen or twenty miles, and run the risk of missing the party, and even the route."[50] I will show below that there was no unbroken four-day blizzard. "The only way Cherry-Garrard could take the dogs south was to kill them for dog food as he went,"[51] or "he could not travel further south with the dogs as he had no food for them".[52]

However, upon his arrival to One Ton Depôt on Mar. 3rd, 1912, Cherry-Garrard had food rations for dogs for the next two weeks, that is until Mar. 17th. This is precisely why he departed from One Ton Depôt on 1:35 am of Mar. 10th, 1912. During that time, at One Ton Depôt, the dogs were obviously fed. Therefore, there was a window of opportunity to go south. There was no shortage of food for the party (both humans and dogs) or the continuous blizzard. If Cherry-Garrard was willing to change the day & night routine and use the flexible tactics of "pitch a tent and go when you can", then it seems *possible* that he could compensate for blizzards and meet Captain Scott and his party.

What is most striking is that no one, beginning with Dr Atkinson, Cherry-Garrard, and the following authors, looked at the actions of the First Relief Party under Cherry-Garrard's command from a digital perspective. Cherry-Garrard's idleness between Mar. 3rd –10th, 1912 at One Ton Depôt was attributed to: (1) orders from Dr Atkinson,[53] (2) lack of dog food,[54] (3) four days blizzard, (4) Dmitrii's and Cherry-Garrard's health and (5) Cherry-Garrard's inability to navigate.

I have already shown that Dr Atkinson gave orders giving Cherry-Garrard total flexibility in judgment upon arrival at One Ton Depôt. The party would have had 24 days rations of dog food; that is, 14 rations upon arrival at One Ton Depôt. The four-day blizzard did not take place, and only during these four days short-lived blizzard events were observed. To make a point about Cherry-Garrard's claims, let us look more closely at the structure of wind velocities observed at the Ross Ice Barrier by a modern automated weather station positioned in proximity to One Ton Depôt. The name of this station is the Schwerdtfeger weather station, named after Werner Schwerdtfeger (1909–1985),[55] a researcher who worked on Antarctic meteorology. Let us look at the structure of the biggest wind event recorded in the month of March at this station during the modern record (1986–2011). The size of the wind event was calculated as the area under a plot of wind velocity against time. Wind size is proportional to the amount of energy released during a wind event.

The biggest wind event for the month of March in the record of weather data from 1986 through 2011 occurred between Mar. 24th through 31st, 1994, and is depicted on Fig. 2.4. The erratic wind velocity behavior is readily observed. During this particular seven days wind event, the wind velocity rarely approaches gale force, and it can be described as a fresh breeze wind event. To what extent can this particular wind event be called a blizzard? It is indeed a difficult question, and without *in situ* observations, difficult to answer. However, relying on general Antarctic experiences resulting from analysis of various expedition records, one could expect that the fuzzy threshold of fresh breeze wind velocity is a near blizzard condition. Thus, during the biggest seven days wind event recorded between 1986–2011 in proximity to One Ton Depôt, roughly half of the wind event time was a near blizzard event, and by adopting a 'pitch a tent and go when you can' travel method, one could move forward. Of course, the day/night routine should be also adjusted depending on actual conditions.

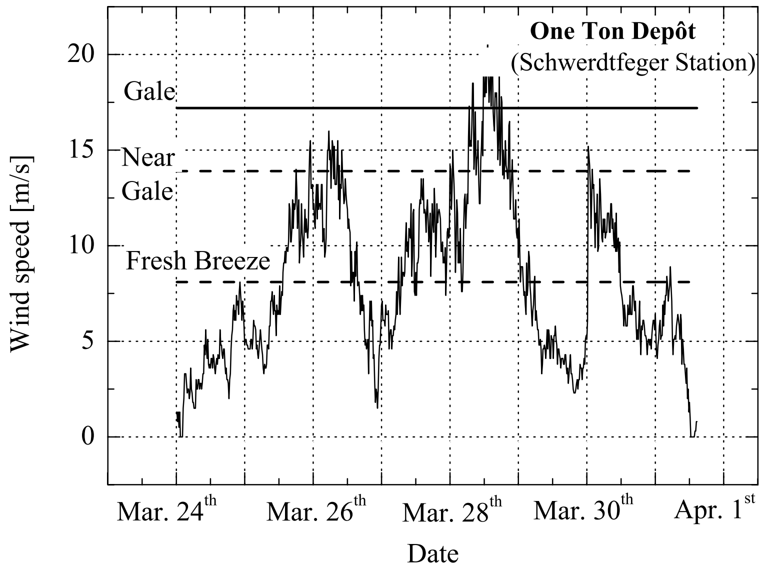


Figure 2.4. The biggest wind event at Schwerdtfeger weather station (One Ton Depôt), in the month of March. The event was recorded between Mar. 24th through 31st, 1994. Horizontal lines illustrate wind velocities defined in the Beaufort scale as Fresh Breeze, Near Gale, and Gale, respectively.

It is accepted in the polar community that blizzard conditions virtually prohibit travel. But the blizzard, understood as a coincidence of wind velocity and air temperature, does not always exclude travelling. Captain Scott, during the spring 1911 western journey, described such a situation[56]

> We only got 2½ miles on the 26th when a heavy blizzard descended on us. We went on against it, the first time I have ever attempted to march into a blizzard; it was quite possible, but progress very slow owing to wind resist-

> ance. Decided to camp after we had done two miles. Quite a job getting up the tent, but we managed to do so, and get everything inside clear of snow with the help of much sweeping.

Thus provided with actual field conditions and judgment, we know it is possible "to march into a blizzard".

Cherry-Garrard's last excuse – inability to navigate – for not being able to travel south is also very dubious to say the least. Cherry-Garrard biographer Sara Wheeler explains in the following[57]

> Each man, Scott decreed, should have a rudimentary knowledge of navigation so that in an emergency he could steer a sledge home. He should also be able to take observations with a theodolite, work out the altitude of the meridian and much else. The non-scientists threw themselves into the task of acquiring these skills, none more assiduously than Cherry. But now he went to Scott with a pale face: he was ashamed to tell him, he said, that he couldn't be counted on as a navigator. At first, Scott didn't know what he was talking about. Then, it emerged that Cherry had determined to master the most abstruse navigational problems, and after hours tussling with log tables and compasses despaired of ever being able to do it.

Wheeler's above explanation is indeed only a *partial* account of what Captain Scott ordered, and is not based on practical navigation knowledge. It is simply not true that the knowledge and ability to use a theodolite and subsequent simple mathematical calculations and tables is necessary to be able to move in terrain in a certain pre-defined direction.

The theodolite is a pretty clumsy instrument, and to use it to determine direction during the daily sledging marches would be a tireless and time-consuming procedure. No other expedition was using a theodolite to determine its sledging course (not to be confused with geographical location determination).

Captain Scott at this point – on the subject of the importance of being able to determine geographical directions – was very cautious, as he knew that various parties would be travelling in the featureless the Ross Ice Shelf and Antarctic Plateau. On June 12th, 1911, Captain Scott ordered every *officer* who would participate in the *Southern Journey* to acquire certain navigational skills. Captain Scott listed in his order 8 skills to be learned. I list here only the first four[58]

1. Every officer who takes part in the Southern Journey ought to have in his memory the approximate variation of the compass at various stages of the journey and to know how to apply it to obtain a true course from the compass. The variation changes very slowly so that no great effort of memory is required,
2. He ought to know what the true course is to reach one depot from another,
3. He should be able to take an observation with the theodolite,
4. He should be able to work out a meridian altitude observation.

The skills to be acquired are listed in the rank of their field importance. The essential navigational observation made by Captain Scott was that if magnetic varia-

tions of a compass at various locations are known, then the traveler can follow these variations and travel in a certain direction.

I have already discussed magnetic deviation (variation) in Chapter 1, in relation to false charges for not reporting true wind directions by Lt Royds during the *Discovery Expedition*. Captain Scott's methodology was as follows. During the process of depot laying to One Ton Depôt, at every camp along the *route*, its precise geographical location was established by means of theodolite measurements. Simultaneously, magnetic declination (variation) was estimated. Thus, along the route from Hut Point and One Ton Depôt, a string (chain) of depot-to-depot declination was established. A similar effort, but during the next season, led to the establishment of a string of depot-to-depot declinations from the foot of the Beardmore Glacier. On Fig. 2.5 I have depicted the variation of magnetic declination (variation) along the Hut Point – Beardmore Glacier *route*.[59]

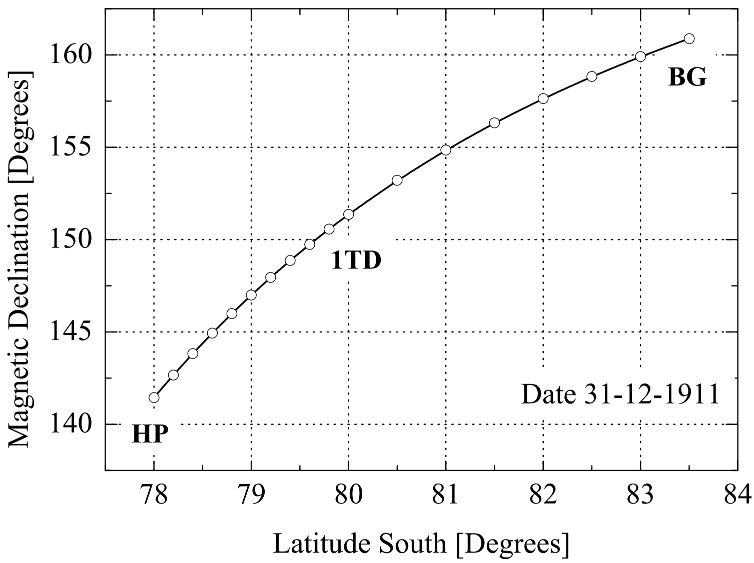


Figure 2.5. Magnetic variation (declination) *vs*. latitude and longitude 166.40 calculated[1] for date Dec. 31st, 1911. Approximate locations of Hut Point (HP), One Ton Depôt (1TD) and Beardmore Glacier(BG).

1 http://www.ngdc.noaa.gov/geomag-web/#declination

In a way, it was like establishing *GPS*, or its European counterpart *Galileo*, at the Ross Ice Shelf. The traveler did not need to make tedious measurements and/or calculations. The traveler was just required to pull out his compass and look at its declination, and follow from one camp to another depôt and Hut Point. Therefore, the traveler could at least theoretically travel not only during the day, but also at night and/or during *adverse* meteorological conditions. These adverse conditions would mean for example blizzards, unless the wind power did not prohibit one to walk and pull a sledge. What was indeed required was the ability to look at the compass and steer along the *route* indicated by its needle.

An example of field data with magnetic declinations (variations) is shown by Captain Scott in his journal on page 128 (book edition), under the heading *Summary of Marches Made on the Depot Journey*.[60]

The above analysis converges with the navigational skills described by Captain Scott in skills 1 and 2. Skills 3 and 4 were needed only when the polar party was entering an entirely new location. Cherry-Garrard was not an RN officer, and thus Captain Scott's request to master navigational skills was not directly addressed to him. Nevertheless, he attempted to learn. Apparently[61]

> Scott confided in a letter to Reggie that there wasn't one chance in a hundred that Cherry would have to navigate, and that if the one chance came off he would need only the simplest skills; but Scott was pleased to have chosen a man who took his work so seriously. Cherry's powers of concentration and application seemed to work on just two setting: on and off. There was no 'moderate'. And as for that one chance in a hundred …

It appears that Cherry-Garrard not only could not grasp how to use a theodolite in measuring geographical locations, but that *also* he could not use a compass. The procedure of using compasses is indeed simple. Since magnetic declination in the Ross Ice Shelf area is positive (see Fig. 2.4), the true bearing = magnetic bearing + declination. The true bearing is the direction of traveler from one location to another. Combining the right travel direction with sledge-meter was a winning navigational solution.

The American travel writer Paul Theroux once commented 'When people ask me … "What is your favorite travel book?" I nearly always name this book. It is about courage, misery, starvation, heroism, exploration, discovery and friendship'.[62] The book is, of course, Cherry-Garrard's acclaimed book *The Worst Journey in the World*. However, in this hefty "travel" book with more than 700 pages depending upon the edition, there is only a few references to using a compass. These references are present in Lashly's diary, which Cherry-Garrard reprinted in his book[63]

> *31st January, 1912*
> Another very- good run to-day but the light being very bad we had to continually stop and steer by compass. This a difficult task, especially as there was no wind to help keep on the course,
>
> *15th February, 1912*
> We started in fine weather this morning, but it soon came over thick and progress became slow. We had to continually consult the compass, as we have had no wind to assist us,

These entries are proof that Captain Scott's method of finding direction by using a compass was in good use. In this case, it was probably Lt Evans who was taking observations. It is precisely as Captain Scott ordered in point 2 of his request for specific navigational skills (see also subsection 11.1.5).

Cherry-Garrard in the following describes with disarming honesty his feelings at the departure from Hut Point to the relief of the Captain Scott Party[64]

> I confess I had my misgivings. I had never driven one dog, let alone a team of them; I knew nothing of navigation; and One Ton was a hundred and

> thirty miles away, out in the middle of the Barrier and away from landmarks.

However, the above describes not only Cherry-Garrard's feelings. More importantly, it gives hapless evidence that Cherry-Garrard could not learn the most simple task: to add up two numbers (the true bearing = magnetic bearing + declination). He could not also learn how to read a sledge-meter to figure out the distance travelled. This is not even amateurism. In light of Cherry-Garrard's nonsensical admission, his usage of the plural form 'We were full of intellectual interests and curiosities of all kinds'[65] in his summary of the expedition sounds terribly pathetic.

Cherry-Garrard's navigational task could be simplified even further. Although magnetic declination between 81.48, the farthest possible point Cherry-Garrard could reach, is not linear, one can very well approximate it by a linear fit, and thus the traveler has to follow it all the way down to Hut Point using *one* true bearing. In such a case, the party will not follow Captain Scott's original route, but eventually will get back to Hut Point.

Despite what I have presented above, the "sophisticated" calculations of geographical locations, the common sense of Russian dog driver Dmitrii Girev, and the resilience of the dog teams enabled the passenger Apsley Cherry-Garrard to safely travel between Hut Point and One Ton Depôt.

Not long after Cherry-Garrard and Dmitrii's return to Cape Evans, the decision was taken to dispatch the Second Relief Party. Years later, Captain Evans described the actual events[66]

> After discussing the situation fully, Atkinson and Keohane started out alone to succour Scott's party. It was on March 26 that Atkinson and Keohane set out, this being later in the year than we had sledged in 1911, when it will be remembered we gave up depot-laying on account of the hardship entailed, although we were fresh men and had not undergone the severe test of a long season's sledge work. Atkinson could only manage about nine miles daily, he and Keohane got practically no sleep owing to the cold, and they turned homeward.

Neither of them, Dr Atkinson or Keohane, could manage dog sledging, and they resorted to standard man-hauling techniques. Their progress was very slow, only nine miles per day. In Tab. 2.4, I have summarized the weather data recorded by the Second Relief Party. At a glance, it is evident that weather conditions were mild in comparison with those described by Captain Scott. Temperatures, including minimum temperatures and wind velocities, were by far higher and smaller, respectively, than these which have been reported for weeks prior by Captain Scott, who was presently dying with his companions 22 miles from One Ton Depôt.

Captain Scott in his journal reported that their last camp was hit by a 9/10 day *gale*. "Since the 21st we have had a continuous gale from W.S.W. and S.W."[67] Since the entry is dated Mar. 29th, one can assume 9 or 10 days of "a continuous gale". One can easily see in Tab. 2.4 that the winds recorded by the Second Relief Party were in the range 3–4 (gentle-moderate breeze) on the Beaufort scale, while Captain Scott allegedly experienced a *gale*, Beaufort number 8.

Table 2.4. The Register of the Second Relief Party.[1]

Date	Time	Dry Bulb Temperature [°F]	Wind Force	Minimum Temperature [°F]
Mar. 27th	14:30	+2.5	3	
	17:30	–3.5	3	
Mar. 28th	7	–6.5	2	–6.0 (?)*
	12:30	–15.5	3	
	17	–6.5	1	
Mar. 29th	7	–3.5	1–2	–13.0
	12:30	–0.5	–	
	17:30	–0.5	1–2	
Mar. 30th	7	–8.5	1–2	–16.0
	12	–3.5	3–4	
	17:30	–5.5	3–4	
Mar. 31st	7	–13.5	3–4	–13.0(?)*
	11	–13.5	3–4	
	17:30	–13.5	3–4	
Apr. 1st	7	–17.5	2–3	–17.0(?)*
	12	–15.5	3–4	
	16	–17.5	3–4	

* These minimum temperatures look suspicious if one compares them with dry bulb temperatures.
[1] George C. Simpson, *Meteorology*, Vol. III, *Tables*, Harrison and Sons, Ltd., London, 1923, *cf.* p. 678.

Not only did the supposed lack of sleep force Dr Atkinson and Keohane back to Hut Point. The final excuse for the return of the Second Relief Party was clearly explained by Dr Atkinson[68]

> On the 30th [March 1912] we made out from White Island, then a few miles south of Corner Camp. We returned to the motor, taking up the sledge left there by Lieutenant Evans, and then on to Corner Camp. Taking into consideration the weather [*sic*] and temperatures [*sic*] and the time of the year [*sic*], and the hopelessness of finding the party except at any definite point like a depot, I decided to return from here. We depoted the major portion of a week's provisions to enable them to communicate with Hut Point in case they should reach this point. At this date in my own mind I was morally certain that the party had perished [*sic*], and in fact [*sic*] on March 29 Captain Scott, 11 miles south of One Ton Depot, made the last entry in his diary.

From the presentation of Dr Atkinson's account in Vol. II of *Scott's Last Expedition*, one may get the impression that they are reading the actual field journal. However,

the above and remaining descriptions of the events by Dr Atkinson were prepared *post factum*.

Dr Atkinson's conjuncture is surprising, because of its appeal to moral issues in a *post factum* fashion. One can wonder why Dr Atkinson used a moral, not *arithmetical*, rationale of his estimate of the situation. Dr Atkinson's statement 'At this date in my own mind I was morally certain that the party had perished'[69] confirms my analysis of the pointless rationale behind dispatching the *First* Relief Party. Why did Dr Atkinson not arrive at the discussion presented above in Scenarios 1 & 2?

In more general terms, anyone, including Dr Atkinson, could obtain the general equation of the return time of the Captain Scott party

$$1^{st}\ \text{Nov. } 1911 \xrightarrow{\text{144-days}} 25^{th}\ \text{Mar. } 1912\ \text{(Delay:}$$
$$\text{Nov. } 3^{rd} + 4\ \text{days blizzard} \sim 1^{st}\ \text{Apr. at Hut Point)}$$

Provided that from Corner Camp to Cape Evans can be traversed in two/three days (though McMurdo Sound was not frozen at these dates in 1912 and an obligatory stop at Hut Point was required), Dr Atkinson could expect the Captain Scott party at Corner Camp on exactly Mar. 30th, 1912. Why then was Dr Atkinson "morally certain"? The answer is that he was *hindsight* certain.

At the time of actual judgment in March 1912, both Cherry-Garrard and Dr Atkinson played a game of feigned attempts to save Captain Scott and his companions. In March 1912, there was no moral, meteorological, or any other reason and/or ground for giving up the relief attempts.

An additional testimony of tacit agreement of not launching true and effective attempt(s) to meet at the Ross Ice Shelf the Main Polar Party – and as we learned *post factum*, to rescue Captain Scott, Dr Wilson and Lt Bowers – comes not only from *The Worst Journey in the World*, but also from Cherry-Garrard's diary.

Upon arriving at One Ton Depôt on Mar. 3rd, 1912 Cherry-Garrard wrote in his diary "There is no sign of Scott here & so perhaps he will get in soon & all will be well". This particular comment suggests that he was thinking about Captain Scott's party as travelling according to discussed above first and the most optimistic point 1 of Scenario 1.

The next day, Mar. 4th, Cherry-Garrard without a word of justification commented[70]

> I have decided to wait 2 days & then settle what we will do. I think he must be in 2 or 3 days … Goggles very bad all the day & I had to trust D. for the cairns – but he is splendid with them – He says in this weather we should give the dogs more food than their rations as they are losing their coats. I have agreed. This leaves us with 13 more days dogs food including today's feed.

Cherry-Garrard's account is a bit surprising. It appears that he is following Scenario 1, in his account of possible Captain Scott party arrival, but at the same moment, while willing to increase dog's rations he gives a figure (13) which, one day after arrival, is consistent with having 14 dog rations upon arriving at One Ton Depôt. However, an even bigger disclosure awaits one who follows Cherry-Garrard's diary until Apr. 2nd, 1912. On this day, because the McMurdo Sound was not frozen, he

was still at Hut Point from his journey to One Ton Depôt. Cherry-Garrard wrote [*sic*][71]

> We have got to face it now, the Pole Party will not in all probability ever get back. And there is no more that we can do. The next step must be to get to C. Evans as soon as it is possible, & there are fresh men there at any rate fresh compared to us.

From the above it appears that Cherry-Garrard is not anymore thinking about Captain Scott's travelling schedule in terms of Scenario 1. His estimate of the situation falls under the above described unjustified judgment by Dr Atkinson that "At this date in my own mind I was morally [*sic*] certain that the party had perished". How more useful would be not moral certainty but mathematical (elementary) calculations. But then, if one then and/or now would make simple calculations and disclose the results, the actions of Cherry-Garrard and Dr Atkinson would call for difficult and uneasy questions.

At any rate, it is always more useful to blame something (blizzard(s), inability to navigate, *etc*.) or somebody else than to face our own fears and unveilings, and to risk our own life to save somebody else's life. Upon return on Mar. 17th, 1912 to Hut Point, Cherry-Garrard noted in his diary[72]

> Dimitri is quite well. It is sad that he has really been shamming ill, it has made the last journey very bad & it is all rather disgraceful. He just hasn't got the guts.

This is an unbelievable defamation of Dmitrii Girev who, had he known what Cherry-Garrard was doing, would likely have done what it took to reach Captain Scott. If a person had malingered on a polar journey, that person could never be trusted again to not do so, due to the stakes involved in any Antarctic journey in the Heroic Age. Yet reading *The Worst Journey in the World* and Raymond Priestley's *Antarctic Adventure: Scott's Northern Party* shows that Dmitrii was entrusted by the expedition with other journeys, including two depot-laying journeys to prepare for the Search Journey[73], the Search Journey itself[74], had a depot named after him[75], and even had a part of Mount Erebus named Dmitri Peak [*sic*] in his honor.[76] Entrusting someone with vital journeys and naming features after them *is not how a malingerer is treated*. A further surprise appears if one reads the post-*Terra Nova Expedition* announcement of the awarding of Polar Medals to the survivors.[77] At the bottom of the list of Silver Polar Medal recipients is Dmitrii Girev, under his improperly Romanized name of "Demetri Gerof".

Since when are malingerers permitted to receive the Polar Medal? It is clear that Cherry-Garrard lied about Dmitrii malingering, and that no one actually believed he was a malingerer.

A far darker tale is hinted at in the confused early days after the *Terra Nova* returned in 1913. First came this statement to the *New York Times* on Feb. 14th, evidently from the by then Commander Evans since it was listed as being among the official statements from the expedition[78]

> Dmitri wished to make a dash southward, but Garrard was ill and overruled him.

On the same day, either Commander Evans or an unknown expedition member confirmed part of this statement in a statement to the *Daily Mail*[79]

> The dog driver, Demetri, who, with Cherry-Garrard, made the first relief journey towards the south, wanted to make a solitary dash further south from One Ton Camp, which they left on March 10, but did not persist.
> The deaths, as already stated, took place eleven miles from One Ton Camp. Garrard and Demetri were very ill when they returned to base.

Whoever they were evidently got this information from Dmitrii and Cherry--Garrard. This raises the question: did Cherry-Garrard malinger, lie about Dmitrii, and Dmitrii never realized it? Evidently Commander Evans and the rest realized that he had let classified information out, judging by this statement just three days later[80]

> A dispatch to the Daily Mail from Christchurch, N. Z., says:
> "All the surviving members of Capt. Scott's expedition bitterly resent the suggestion that the dog driver, Demetri, and Cherry-Garrard, who made the first relief journey toward the south, could have done any more than they did to save Scott and his comrades.
> "All express the highest admiration for the work of Dr. Atkinson, who knowingly took enormous risks.
> "Commander Evans asserts that absolutey nothing regarding the expedition has been held back."

Dr Max Jones distorted this chain of events into the following falsehood[81]

> The New Zealand press even reported that Dimitri Gerof wanted to press on, but was prevented from doing so by his companion - a report which infuriated Cherry-Garrard. Teddy Evans emphatically denied the accusations and Central News issued a statement that Scott's family felt assured that every possible effort had been made to assist the southern party.

⋮

Captain Scott was a British Royal Navy officer, and surely he was acquainted with the Beaufort wind force scale. He used this term to describe wind force at sea and on land. On Oct. 30th, 1911, just before he started for the South Pole, Captain Scott observed that "after a fine morning, we have a return to blizzard conditions. It is blowing a howling gale as I write."[82]

Consulting *Table 13: Wind-Hourly Values of Velocity and Direction*[83] of Dr Simpson's treatise, one can see that Captain Scott was correct in his description and usage of the term *gale*. On this day, from midnight until 9 am, the wind speed changed from zero to three miles per hour. In the Beaufort scale, from calm to light air. However, after 9 am, the speed of the wind steadily increased, reaching 39 mph at 11–12 am, and continued for the next 24h with a maximum speed of 46 mph on midnight of Oct. 30th. According to the Beaufort scale, the winds with speeds of between 39–46 mph are classified as gale and denoted 8 in this scale. Therefore, Captain Scott's usage of the term *gale* was accurate. An additional comparison of particular gale entries in his journal with specific wind measurements at Cape Evans further confirms the right usage of the term. How, then, was it possible that Captain

Scott recorded Beaufort scale winds of gale proportions, and Dr Atkinson, while fully exposed to the Barrier influences at the same time, recorded no more than a light breeze (4–7 mph, or 2 in the Beaufort scale)?

Dr George Simpson's analysis of blizzards at the Ross Ice Shelf, as depicted on Fig. 1.7 in the previous chapter, strongly suggests that the gale recorded by Captain Scott between Mar. 21st through 29th, 1912 must be observed at Corner Camp, which Dr Atkinson and Keohane walked towards on Mar. 29th and camped at on the next day. I will address this question in more detail in Chapter 8.

Captain Evans' comment in *South with Scott* that "he [Dr Atkinson] and Keohane got practically no sleep owing to the cold, and they turned homeward" is one of these ambiguous conjunction sentences, which give the reader room for speculation. I personally read this as him being duped by a justification supplied by Dr Atkinson. Although night temperatures were not terribly low (on average –12°F) compared with other parties at different times, one can conceive that Dr Atkinson and Keohane could rest (sleep) during the day when the average temperature more than twice as high (–5°F).[84] Certainly –5°F is not a terribly low temperature in Antarctica.

Captain Evans not only added his own misinterpretations, but amplified figures concerning temperatures and duration of blizzards. He quotes what he says is from Tryggve Gran's diary, but in all probability is an alternative account that Gran provided him, since it is not the account used in the published English version of Gran's diary[85]

> It has happened – horrible, ugly fate, only 11 miles from One Ton Depot, Scott, Wilson, and Birdie. All ghastly. I will never forget it as long as I live: a terrible nightmare could not have shown more horror than this 'Campo Santo.' In a tent, snow covered to above the door, we found the three bodies. Scott in the middle, half out of his bag, Birdie on his right, and Uncle Bill on the left, lying head towards the door … Bowers and Wilson seem to have passed away in a kind of sleep … Concerning our unlucky Polar Party we learned that Petty Officer Evans died at the Lower Glacier Depot; he was done, and had fallen coming down the Glacier: death was the result of a concussion of the brain. On the Barrier they met with extreme low temperatures. Down to –50 degrees [*sic*] in the night time for weeks, also head wind.

Suffice to say that that the temperature was "–50 degrees in the night *for weeks*" is a glaring exaggeration. This false temperature value was, without simple verification or common sense, recited and used by Dr Barczewski[86] for the further confusion of the readers and polar enthusiasts, as we will see in section 5.3. The question of temperature scale remains open, as Gran did not specify one; however, I believe he was refereeing to the Fahrenheit scale.

It was Charles S. Wright, who on Nov. 12th, 1913 "Found Owner, Bill & Birdie in tent … Cold and exhaustion did for them, capped by the week's blizz[ard]."[87] Roughly sixty-two years later, Silas described his frightening finding in more detail in his memoir[88]

> Next day we found the Owner, Wilson and Bowers in their tent. To me this came as a complete surprise as I had been quite certain that we would find they had perished among the crevasses on the Beardmore Glacier. I had been plugging along my chosen course when I saw a small object projecting above

the surface on the starboard bow but carried on the chosen course until were nearly abreast of this object.

I decided [it] had better be investigated more closely, but did not expect it was of great interest so told the mule train to continue south while I went over the ½ mile or so to examine what it was. I tried to signal my party to stop and come up to me, but my alphabetical signals could not be read by the Navy and I considered it would be a sort of sacrilege to make a noise. I felt much as I were in a cathedral and found myself with my, hat on.

At the exact spot of the last camp of Captain Scott and his two companions[89]

The large cairn was surmounted by a cross made of ski runners and the note recorded by Cherry and signed by all members of the Search Party "A slight token to perpetuate their gallant and successful attempt to reach the Pole – inclement weather and lack of fuel was the cause of their death." The death of Evans on the Beardmore Glacier and the death of Oates in his pitiful attempt to ensure of the three others is also commemorated in this record.

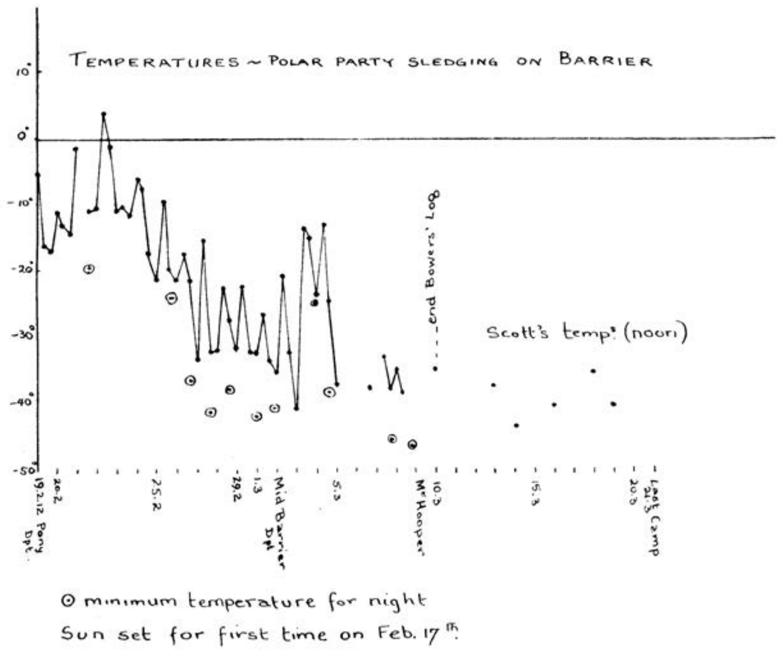


Figure 2.6. Reproduction of Charles S. Wright's (Silas) original chart[1] depicting his analysis of temperatures recorded by Captain Scott's party. The bottom scale from left reads (dates): 19 2 12, 25.2, 29.2, 1.3, Mid Barrier Depot, 5.3, Mt Hooper, 10.3 (end Bowers' log), 15.3, 20.3, 21.3 Last Camp. The solid line connects Scott's temperatures at noon with the minimum temperatures for the night.

[1] Collin Bull and Pat F. Wright (Eds.), *Silas: The Antarctic Diaries and Memoir of Charles S. Wright*, Ohio State University Press, 1992, *cf.* p. 374.

Because "Atch [Dr Atkinson] took the diaries and later read to us all the parts that enabled us to know roughly what had happened" the search party judged that it was "inclement weather and lack of fuel". So, it was "inclement weather" after all. However, the sturdy Canadian sledger and expedition physicist would not give up his days with expeditions. Years later, and not long before his death 'Silas' Wright wrote[90]

> Here, with Cherry, I take issue with Simpson. The only available information about this reduction in temperature which seems to have been relevant are the temperatures recorded on Shackleton's return journey of 1908. So far as I have been able to do so, I have examined the few numbers mentioned in his book, The Heart of the Antarctic [Shackleton, 1909]. In this account, the first below zero temperature (F) is noted on February 15th, with lower figures of –7°F and –10°F, and a sharp drop to –20°F and –35°F opposite the Bluff. Note that these figures were reported from an area not very far [from] (but north of) One Ton Depot, when the sun was about to set in the evening. From Birdie's temperature records I note that the first mention of below zero temperature is on February 18th, and of –20°F on February 26th, after which time the temperature was almost consistently in the minus thirties, and minus forties as the minimum night temperature.

Finally, Charles Wright concluded what his issue with Dr Simpson was

> In view of the sharp reduction in temperature recorded by Shackleton in his book, I suggest it is worth examining his full meteorological sledging record. I find it difficult, in view of the low temperatures recorded by [Shackleton as well as by] the Pole Party, to believe this sudden drop in temperature is likely to be unusual, and my belief in that this may be a regular annual change and that insufficient attention has been given to the time of year when outward radiation from the soft snow surface exceeds inward radiation throughout each of the twenty-four hours.

I used this lengthy citation to show what weather related issues were debated between members of the *Terra Nova Expedition*. In here, Wright suggests that the reported low temperatures by Captain Scott in late February and March 1912 were a part of 'regular annual change,' and not abnormal temperature decrease as suggested by Dr Simpson. For more on Dr Simpson's analysis, see Chapter 3.

In order to support his thesis, Wright used Lt Shackleton's *Nimrod Expedition* temperature data.[91] Let us look more closely at the temperatures attributed by Wright to Lt Shackleton, as depicted in Tab. 2.5.

Before commenting on Wright's data, one has to recall a few facts about Lt Shackleton's *Nimrod Expedition*. Lt Shackleton's outward journey to the South Pole started on Oct. 29th, 1908. On Jan. 9th, 1909 and 97 geographical miles from the South Pole, Lt Shackleton turned back to base camp at Cape Royds, Ross Island. At about mid-February, the party approached the place where three years and a month later Captain Scott struggled towards One Ton Depôt. Therefore, according to Wright, it was reasonable to compare the temperature data of both the Lt Shackleton and Captain Scott parties.

Table 2.5. Comparison of temperatures reported by Lt Shackleton and temperatures attributed by Charles Wright to Lt Shackleton. All temperatures are given in °F.

Date in 1909	Shackleton	Wright
Feb. 11th	+20	
Feb. 12th	+5, +20	
Feb. 14th	+10, +18	
Feb. 15th	–3 (noon)	–7, –10
Feb. 16th	0, –7	
Feb. 17th	–10	
Feb. 18th	–20	Less than 0
Feb. 19th	–10	
Feb. 20th	–20	–20
Feb. 21st	–37	–35
Feb. 23rd	+10	
Feb. 26th	–	–20
After Feb. 26th	–	–30÷–40

However, Wright's attempt to make a comparison of Lt Shackleton and Captain Scott temperature data is incorrect. In particular, Wright suggests the observed sudden drop of temperatures in Lt Shackleton's data confirms local annual changes of temperatures. The confusion arises from assuming that the climate of the Ross Ice Shelf is tantamount to its weather.

The one-hundred year old *Meteorological Glossary* edited by two unfortunate antagonists of Lt Royds, Charles Chree and Sir William Napier Shaw, tells us that[92]

> *Climate*. – A general summary of the weather for any particular locality. When the weather has been observed for a sufficiently long time in any locality we are able to make a useful statement as to the weather which *may* be experienced at any particular time of the year in that locality. Technically, the climate of a place is represented by the average values of the different meteorological elements, which should include means for each month, as well as means for the whole year.

Examining one, two, or three years temperature data on particular days and in particular locations cannot permit one to make sound scientific reasoning about the climate at this location. Certainly, at a given moment of time, one can find hundreds of the same or similar temperature records using thousands of weather stations currently on Earth. It does not permit one to say that the locations are in the climatologically same region.

Consequently, Wright, by looking at several digits representing Lt Shackleton's minute temperature records, could not make a climatologically sound assessment

that in the middle of February at the Ross Ice Shelf, a sudden drop of temperature would represent the local climatology. Obviously, by knowing the general behavior of temperature changes (climate) in polar and/or sub-polar regions, one could/must make the conjecture that in February there is a systematic decrease of the *averaged daily* temperature. Indeed, Fig. 1.6, obtained from averaging temperature data at the Schwerdtfeger (SCH) station (–79.904, 170.105), entirely confirms this conjuncture.

Although, as explained above, Charles Wright – and for that matter Dr Simpson and Captain Scott – could rightly expect a steady decrease of daily temperatures at the Ross Ice Shelf, the most important question arises about the *gradient* of these changes. In 1912, the climatology of the region was unknown, and therefore no guessing game could help in estimating a sound temperature gradient as the winter was advancing.

Despite all of the above, which may be called an incorrect data analysis, Charles Wright had his share of exaggerating temperature data. To account for that, I recall the above-cited entry in his journal

> and of –20°F on February 26th, after which time the temperature was almost consistently in the minus thirties [*sic*], and minus forties [*sic*] as the minimum night temperature.

Easy consultation of Lt Shackleton's book describing his *Nimrod Expedition* confirms that no temperature entries are present after Feb. 23rd, 1909. See Tab. 2.5. Further, if one consults temperature records at Cape Royds, which end on the last day of February, one can see that the minimum temperatures are: Feb. 26th (+7°F), Feb. 27th (3.9°F) and Feb. 28th (–1.5°F), respectively.[93] Lt Shackleton and his companions (Eric Marshall, Jameson Adams and Frank Wild) reached the Cape Royds hut on Feb. 28th, and on Mar. 4th the whole Southern Party was aboard the *Nimrod* and headed towards the north.

In view of the above well documented and straightforward historical evidence, Charles Wright's account that Lt Shackleton encountered at the end of February 1909 temperatures of minus thirty and minus forty at night is entirely unfounded.

Dr Thomas Griffith Taylor was one of the *Terra Nova Expedition's* geologists, and he was one of the most analytically minded of his fellow explorers. Unfortunately, his splendid and detailed descriptions in his book *With Scott: the Silver Lining* are unjustly forgotten. Dr Taylor's book was published in 1916 with an Introduction written by Leonard Huxley. Dr Taylor seems not to regard Captain Scott's arguments presented in the *Message to the Public* as an explanation of the disaster. "Why did the tragedy occur?" asks Dr Taylor, "I am convinced [he continues] that no reason beyond that of Seaman Evans' illness is required."[94]

> When Evans met with his accident, there could be no rest for any, sick or well. It was a race with famine, in which only strong men had any chance. There was no need for a severe accident to handicap the party hopelessly, as in the case of Dr Mertz.[95] A slight ailment rapidly becomes mortal. A sick man must be kept warm, and in the Antarctic the only warming agent is the human one … With each hour's delay each man grew weaker. Each day

> the weather grew worse than the preceding … Each night was longer, each march a harder fight against the blizzard drift."

One cause of the Polar Party's disaster, Evans' illness, may appear as a convenient account, but hardly could avoid questions about the causality of the events which led to Evans' illness. Twenty-four years later, Dr Taylor returned to the question of temperatures[96]

> Temperatures varied very greatly within fairly short distances near Ross Island. Thus in the winter of 1911 Wilson's party on the Barrier on July 6th experienced –76°F, while at Cape Evans it was –43°F, involving a difference of 33°. So also just before Scott died near One Ton Camp the temperature on March 8th was +2°F at Cape Evans (latitude 78°) and –33°F at latitude 79°. Yet later when Dr Atkinson made a short journey on the Barrier on March 28th and 29th the temperature had risen to –5° and –7°F.

As mentioned by Dr Taylor, low temperatures were observed by Dr Wilson, Cherry-Garrard, and Lt Bowers on their nearly pointless and nearly fatal excursion to collect Emperor penguin eggs at their breeding grounds at Cape Crozier. During their 60 mile trip, they essentially traversed the south fringes of Ross Island and crossed over the ice bight. Because it was quite windless, the name given to it was the Windless Bight. Due to its location, the direction of Barrier winds from the south and blocking heights of Mts. Erebus (3794 m) and Terror (3230 m), it is also the coldest place in the Ross Island area. This observation was confirmed by the modern automated weather station named Windless Bight Station, located just at the middle of the bight.[97]

Although Dr Taylor gives a 35°F temperature difference between Cape Evans and Dr Wilson's party, he also tells of temperature differences between base camp and Captain Scott's party. However, his citation is incorrect. The reported temperature difference by Captain Scott was much bigger. On Mar. 8th, Lt Bowers reported a minimum temperature of –45°F[98], while at Cape Evans the minimum temperature was +0.1°F.[99] The true difference is about 45° instead of 35°. Similarly disputable are Dr Taylor's temperature records related to Dr Atkinson and Keohane – the Second Relief Party Mar. 27th through Apr. 1st, 1912. Dr Atkinson's and Cape Evans recordings on Mar. 29th and 29th were –6°F, –13°F and 6.3°F, 8.5°F, respectively.[100] These inaccuracies from Dr Taylor are indeed rare, and his insight was otherwise remarkable and analytical.

The analytical character of Dr Taylor thinking led him in 1916 to comment[101]

> I do not believe that unaided the three men would have survived even if they had reached One Ton Depôt. There was no chance of thorough rest there, and nothing else could have saved them. At their slow rate of marching they were still ten days from Discovery Hut [Hut Point], and such a period of exposure would have been too much for them.

This simple and sad truth – though from a wrong premise of the polar party wanting to survive – was long forgotten by following readers and authors, for whom deliverance of the remaining party was associated with the reaching or not reaching One Ton Depôt. The One Ton Depôt was not a salvation to the Captain Scott party,

Figure 2.7. Sledge-mates at Cambridge, November 1913: Frank Debenham, Charles S. Wright, Griffith Taylor, and Raymond E. Priestley.

even if it was provisioned as the Owner ordered. Even if they somehow reached this illusionary recovery depôt on the Barrier, it is certain that there or on their journey further south they would certainly perish. The only possible and realistic relief/support which could save or truly attempt to save their lives was scrambling back to the base camp at Cape Evans Hut. However, the remaining fellow explorers at Cape Evans were preoccupied with their own lives and well-being.

Two remaining fellow explorers of the *Terra Nova Expedition*, geologist Raymond E. Priestley and camera artist Herbert G. Ponting, have also written their own accounts.[102, 103] Priestley did not address the matter of low temperatures encountered by Captain Scott. Furthermore, Ponting also skipped possible questions of temperature and repeated Captain Scott's journal entries.

Is it possible that Captain Amundsen had the Faustian devil's (troll's) pact with nature to be kind to him? I personally doubt the very possibility. However, I understand that some (a very few) speculative minds, like the *Terra Nova Expedition* camera artist Herbert Ponting who left Cape Evans with Dr Simpson, and at the time of commenting did not know the outcome of Captain Scott's journey[104]

> Within four months of our departure from New Zealand he had lost nine ponies out of nineteen, nearly half the total transport on which he was relying. It would be impossible to overstate the seriousness of this loss. Had any

> more ponies succumbed, the main objects of the Expedition could not have been achieved, as success was entirely dependent on the transport animals. It was due to this misfortune that Captain Scott did not start on the Pole journey till November 1st, 1911. His original plans [*sic*] provided for leaving his base on October 1st; but October is [*sic*] a very cold and tempestuous month, and to have exposed the surviving transport animals to the additional hardships such weather entailed, would have involved too grave a risk. He, therefore, reluctantly [*sic*] postponed the start a month. That month [*sic*] perhaps lost for Scott the honour of being first at the South Pole. But for this delay it is conceivable that the rival explorers might even have met [*sic*] at the goal of their hopes.

Ponting's account is curious. It could have served as a template for future accounts, including Captain Scott's *Message to the Public*. Ponting's account deriving from the unquestionable loss of nine ponies is wrong and self-contradictory. Indeed, his description is tortuous and causally confusing. At once, Ponting suggests that Captain Scott was unaffected by nature; then shortly after that, Captain Scott was rather coping with nature.

First, Ponting tells us that Captain Scott's "original plan" was to start the journey to the South Pole on Oct. 1st. Right after that, Ponting realizes that October "is [*sic*] a very cold and tempestuous month" and the ponies, "surviving transport animals", cannot be exposed to "additional hardships". Therefore, Captain Scott "reluctantly

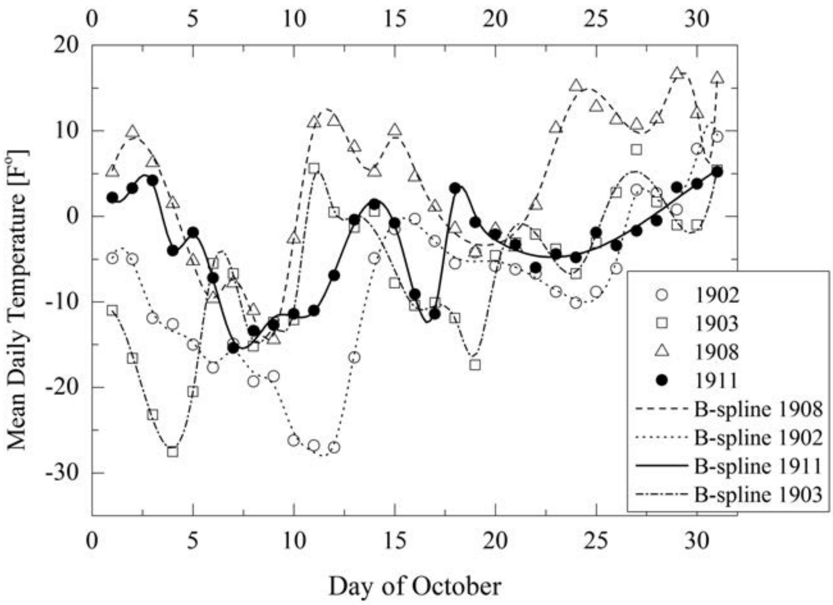


Figure 2.8. Mean daily near surface temperatures recorded at Hut Point during the *Discovery Expedition* (1902, 1903), Cape Royds during the *Nimrod Expedition* (1908), and Cape Evans during the *Terra Nova Expedition* (1911). Temperature data points are connected by B-spline lines.

postponed the start a month". Ponting's comment "but October is a very cold and tempestuous month" is entirely confusing. It looks like Ponting had climatological data and could say within this frame that October *is* a very cold month. However, it was not the case, and before October 1911 came, temperature records for October 1902, 1903 (*Discovery Expedition*) and 1908 (*Nimrod Expedition*) were available and were the best data available, as scant as they were in a climatological sense.

At the time of deciding when to depart to the South Pole, two pertinent answers must be found to two following questions:

1. In what temperature range can ponies sustain sledging journey?
2. In what range of temperature does the Barrier fluctuate in planned journey months?

By no means simple questions, and I doubt that they were addressed by Captain Scott, even though for obvious reasons he was dramatically short of weather data from Siberia (origin of the ponies) and the Barrier. On Fig. 2.8, I depicted *all* daily mean near surface temperatures recorded before and during October 1911 at Hut Point, Cape Royds, and Cape Evans. Having done so, I picture Captain Scott, Drs Wilson and Simpson making a similar plot in the hut at Cape Evans during the consecutive days of October 1911. What possibly they could reason from such a plot *provided* (which is doubtful) that they knew (from Meares' knowledge of the ponies' Siberian home) the range of temperatures which the ponies could sustain. I think that no edu-

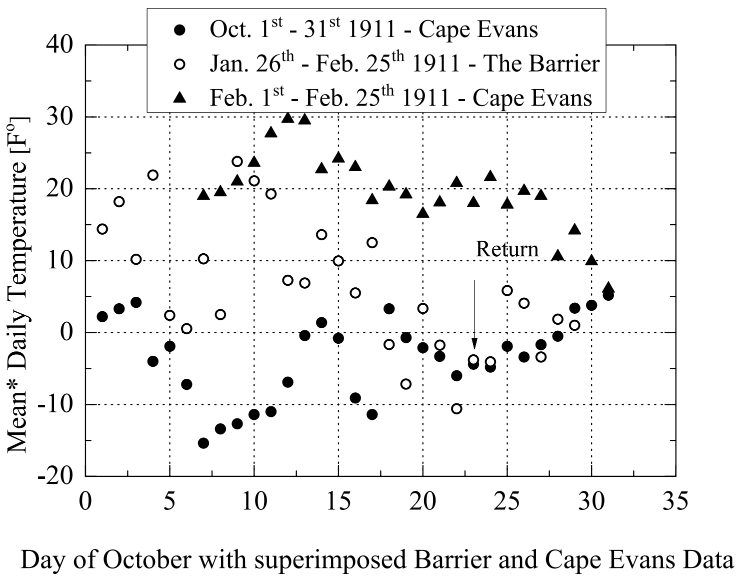


Figure 2.9. Mean daily temperatures recorded at Cape Evans Oct. 1st through 31st (●), with superimposed mean daily temperatures recorded during the One Ton Depôt Party, Jan. 26th through Mar. 23rd, 1911 (○), and at Cape Evans Feb. 1st through Feb. 25th, 1911. Asterisk (*) denotes warning that each mean was calculated as an arithmetical mean from a temperature record taken at different time intervals. The mean temperature at the Barrier was calculated from all temperature data (usually three points), including the minimum temperature.

cated guess of Captain Scott's departure date to the South Pole could be made out of all mean temperature data points, including the October 1911 data. The investigative reader my consult at this point Fig. 3.10, which depicts similar data, but for Captain Amundsen's premature departure in September 1911.

However, Captain Scott's window of opportunity was from the beginning measured by his assumption of 144-days sledging duration, and his thus derived assumed sustained sledging velocity of about 10.1 miles per day. No sensible assumption about the weather conditions could be made. I think a hint of how the ponies would perform during the South Pole journey was gained during the One Ton Depôt laying journey, Jan. 26th through Mar. 23rd 1911. It certainly was what Captain Scott was planning in 1910[105]

> One difficulty, which may be experienced in starting the main journey may be the regulating of speeds of the different units. That is to say, the dogs may go faster than the ponies, and so on. I hope we shall be able to discover what those speeds are by the depot journeys, which will be started in the autumn directly we get south. We shall get from two to three months of good weather.

The next Fig. 2.9 illustrates my point. This figure illustrates the characteristic feature of a negative temperature gradient between Cape Evans (Hut Point) and the Barrier, where temperatures are about 20 Fahrenheit degrees lower than these recorded at Ross Island. If Captain Scott was certain about this temperature difference feature

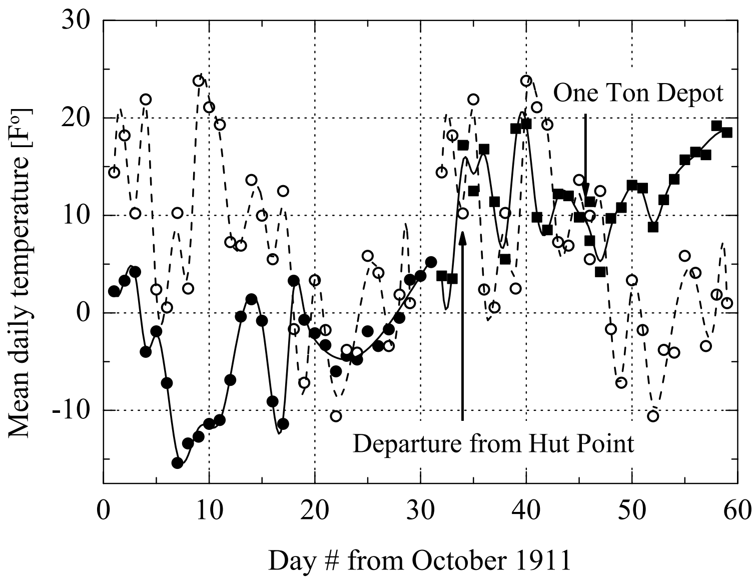


Figure 2.10. Mean daily temperatures recorded at Cape Evans in October (●) and November (■) 1911. The mean daily temperatures (○) calculated from temperatures recorded during One Ton Depôt laying journey are also superimposed on the October and November data at Cape Evans. Solid and dashed lines represent B-spline approximation of temperature data.

between the Barrier and Cape Evans, he could rightly look at the current temperature and guess the possible temperature at the Barrier.

Recalling the ponies' performance during the laying of One Ton Depôt, when the daily mean temperatures plunged below 10F° (Fig. 2.9, from Feb. 15th, day 15th), Captain Scott got quite good evidence that this is the prohibiting temperature range for ponies (excluding dogs). Combined with the wind (wind chill factor), Captain Scott could not venture from Cape Evans/Hut Point unless the trends in temperature there were trending toward +20F°. Simultaneously, the 144-days sledging duration enforced a not too late return date, so humans could sustain the weather conditions on their return leg.

The next Fig. 2.10 clearly shows that Captain Scott's decision to depart from Hut Point on Nov. 3rd, 1911 was not a simple and straightforward decision, as temperatures recorded at Cape Evans were still lower than expected for the required and sustained pony performance. But 144-days sledging duration meant a return date of Mar. 26th/27th, 1912, with the open question of possible temperatures. Upon the Captain Scott party's arrival at One Ton Depôt on Nov. 15th, the mean daily temperature was 10.6F° and plunged the next day to –10.3 F° and the party went on.

Raymond Priestley's[106] account of the Northern Party was published shortly after the *Terra Nova's* return. However, twelve years later, after Captain Scott's meteorologist Dr Simpson summarized the meteorological aspects of Captain Scott's Polar Journey – as I will discuss in greater detail in the next chapter – Priestley felt compelled to spell out his own stand[107]

> The thesis of the lecturer [Simpson during his Halley Lecture] – that the main cause of the Scott tragedy was the weather to which the party was exposed – seems to the writer to be tenable; but several of the points raised would bear more consideration than can be given to them in a short review.

First, Priestley observes that "along the Barrier the parties were all making satisfactory … progress" until the four days blizzard. But the four days delay altered Captain Scott's original plan and

> Urged on by a leader [Scott] of tremendous physique [*sic*], of impatient temperament [*sic*], and for the time being obsessed with one dominating idea, the sledge parties toiled early and late until at last Scott was able to record in his diary that the loss of time on Shackleton's schedule had been made good. At what cost this had been accomplished was not realized until later, on the return journey, the polar party itself began to fail.

Thus, according to Priestley, the four days blizzard meant that the party was "drained of its reserves of strength" by trying to race with "a ghostly pacemaker [Shackleton]". Before proceeding further, let us look in more detail at the question of the comparison between Captain Scott and Lt Shackleton's journeys towards the South Pole. It appears that if Priestley were more analytically gifted, he would not have drawn the above conclusion.

Since both expeditions followed the same route at exactly the same time of the year, it is actually not difficult to compare the distances sledged by both parties. I will examine sledging velocities of Captain Scott, Captain Amundsen, and Lt Shackleton's parties in the next chapter. Here, when looking analytically at Priestley's conjecture,

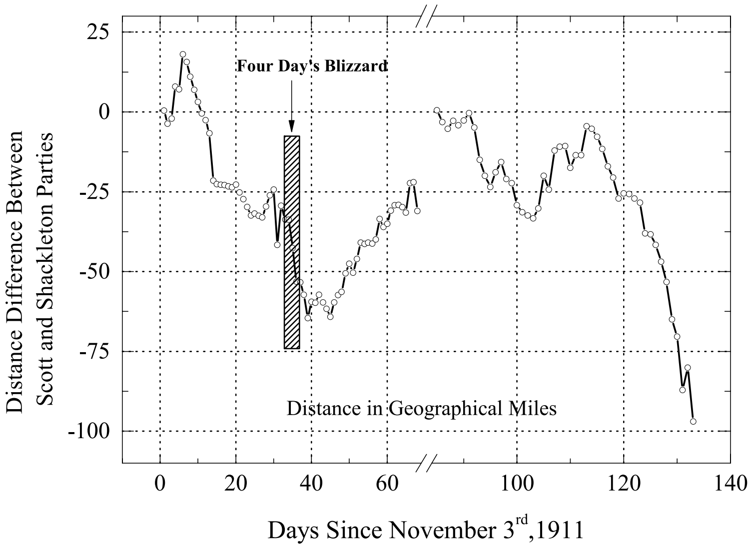


Figure 2.11. Comparison of the difference between daily distances sledged by Captain Scott's and Lt Shackleton's parties. The difference in distance is given in geographical miles. In order to compare distance travelled since the Farthest South at latitude –88.3833 (88°23′S) by both parties, I have used Captain Scott's days count since Nov. 3rd, 1911. Captain Scott reached this location on Jan. 25th, 1912, and Lt Shackleton turned back on Jan. 9th, 1908. Therefore, for comparison purposes, I shifted Lt Shackleton's data from Jan. 9th through Jan. 25th and calculated the difference in the distance travelled.

it will be more illustrative not to look at velocities, but rather to look at the difference between each party's daily velocities. In Fig. 2.11, I depicted the difference between the daily sledged distances of the Captain Scott and Lt Shackleton parties: d = (Scott daily distance) – (Shackleton daily distance). From this formula, it is evident that if d is decreasing, then Captain Scott was sledging more slowly than Lt Shackleton, and if d is increasing, then it means that Captain Scott was sledging more rapidly than Lt Shackleton.

For a couple days from Nov. 3rd, Captain Scott was gaining distance over Lt Shackleton's party. However, starting from Nov. 8th until Dec. 17th, Captain Scott almost continuously (with an exception of a few temporary increases) lost distance. Although Scott dropped further behind Lt Shackleton during the four-day blizzard, one can see that the delay caused by this blizzard is well within the pre-dominative gradient starting on Nov. 8th. Not until Dec. 17th was Captain Scott able to match Lt Shackleton's performance, and on this particular day was about 64 geographical miles behind. From then on, Captain Scott was slowly gaining distance until Lt Shackleton's *Farthest South* at latitude –88.3833 (88°23′S). At this location, Captain Scott was lagging behind Lt Shackleton by about 31 geographical miles.

From this location, Captain Scott continued his journey to the South Pole and back, and on Jan. 25th 1912 reached latitude –88.3966, which is very close to Lt Shackelton's latitude of –88.3833. Again, from this location, I calculated the difference between daily sledged distances as depicted on Fig. 2.8. From Jan. 25th

until Feb. 13th, Captain Scott again was losing distance. After a short period of gaining and losing distance, Captain Scott's party from Feb. 23rd started dramatically to lag behind Lt Shackleton's record, finally being about 100 geographical miles behind.

However, as Priestley points out, the hardships of keeping up with Lt Shackleton's pace played an important role, the most important being "the bad surfaces on the plateau and, on the return journey, on the Barrier were main factors in bringing about the final tragedy". The bad surfaces were due to "peppering of loose crystals upon the surface … [which] acted efficiently as a brake to the sledge runners".

After arguing the above, Priestley makes the argument that not only low temperatures, but also the "*fall of temperatures* with its accompanying deposit of fog crystals" were important factors in finishing off Captain Scott's party.

2.4. Synopsis

In summary, the post-expedition scrutiny, analysis, and reflections by the members of the expedition can be divided into two groups. The first is represented by Ponting and Priestley, who were satisfied with Captain Scott's account and description of events and meteorological data reported by Lt Bowers and Captain Scott. The second group, including Cherry-Garrard, Wright, and Dr Taylor, in various degrees and extended reflection upon the final weeks of Captain Scott's journey and reported temperatures. Their deductions were insightful, but not complete.

But it was expedition meteorologist Dr George C. Simpson, who, equipped with knowledge, data, and scientific enquiry, addressed meteorological questions in the most comprehensive way and detail.

Chapter 3

Dr George C. Simpson's Weather and Climate Tantamount

> *Many meteorologists will look in vain in this book for statistical results with which they have become familiar in similar works. I am no statistician and statistical meteorology has no attraction for me, therefore I have not loaded my discussion with statistical tables. These have all been banished to Volume III which will consist of tables only and will, I hope, prove a happy hunting ground for the statistical meteorologist. On the other hand no statistical investigation has been too laborious when it has been undertaken to unravel some physical problem.*
>
> George Clarke Simpson[1]

Having presented opinions and views of the members of the *Terra Nova Expedition*, I now move to Dr George C. Simpson's summary work on the meteorology of the expedition. Besides Captain Scott's personal journal, it is the most important document related to the *Terra Nova Expedition*. It is a *magnum opus* of Captain Scott's individual persistence in collecting one set of scientific data. No expedition before or after can match this meteorological record, though in a climatological sense this is not saying much. This meteorological record is available not only due to Captain Scott, Dr Simpson, and Charles Wright's assistance, but also due to the remaining members of the expedition who, during field observations in variable weather conditions, were taking minute meteorological observations. Dr Simpson's summary contains a wealth of data, which when combined with data from modern unmanned meteorological stations installed at various geographical locations at the Ross Ice Shelf (the Barrier),[2] and with modern mathematical methods of data analysis, can throw new light on the events of the past.

Dr Simpson, on the contrary to Malcolm Walker's recent mistakes,[3] highly regarded Captain Amundsen's meteorological record by recognizing that[4] "Now that it is possible to review the meteorological work of the expedition as a whole one can see how much we owe to the fact that simultaneous observations were taken for the greater part of a year at *Framheim*, Cape Evans and Cape Adare." And Dr Simpson continued[5]

> When we heard that Amundsen was in the Antarctic, and in consequence the small party under Lieutenant Campbell which Scott had sent to work near King Edward VII Land had to go to Cape Adare instead, we all con-

> sidered it a minor disaster. But for the meteorological work this was an advantage which it is impossible to over-estimate, in fact, it led to a distribution of stations unique in the history of polar exploration and one which could not have been attained by any possible amount of forethought. With these stations working for nearly twelve months simultaneously at the three corners of a triangle embracing the Ross Sea and each station about 400 miles from its nearest neighbour, the records from each station became of highly enhanced value, and problems could be investigated and solved which would have remained unknown after a hundred years of observation at one station alone.

Dr Simpson's meteorological summary consists of three volumes, titled respectively: *Discussion* – Vol. I, *Weather Maps and Pressure Curves* – Vol. II, and *Tables* – Vol. III. Obviously, the last volume is the most valuable, as it is a collection of all meteorological data. The first volume is also of great importance, as it shows Dr Simpson's insight and understanding into Antarctica's general meteorology, including its scientific methodology.

The first volume, published in 1919, contains ten chapters analyzing and discussing all aspects of Antarctica's meteorology. In between them are chapters on temperatures, winds, and a chapter presenting Dr Simpson's view on general air circulation over Antarctica. The last chapter, Chapter X, deals with atmospheric electricity, Dr Simpson's scientific preoccupation which continually fascinated him for years.[6]

The second volume contains the respective meteorological data simultaneously collected at: Melbourne, Bluff,[7] Cape Adare, Cape Evans, *Framheim*, and *Terra Nova* (the ship).

The third volume contains tables of all meteorological measurements, including Tables 67–80 with registers kept on sledging journeys from Cape Evans. As a database (record), Dr Simpson's third volume represents a great meteorological account of the Captain Scott *Terra Nova Expedition*. In Chapter 1, I have shown how Dr Simpson used *Terra Nova Expedition* meteorological data in analyzing general atmospheric air circulation. In addition to the present discussion, in this chapter I will review Dr Simpson's approach to understanding and/or explaining meteorological events described by Captain Scott in his journal during the South Pole attempt. Meteorological data collected by the Captain Scott party and various auxiliary parties were used by Dr Simpson to account for two extraordinary meteorological events described by Captain Scott, namely

1. February 27th through March 27th, 1912 – *Extreme Cold Snap*,
2. March 21st through 29th, 1912 – *Never Ending Gale*.

During the years, on various grounds, different people – fellow explorers, authors, and historians – have made the contention that the above mentioned two meteorological events finished off Captain Scott and his party. In a large degree, these events: *Extreme Cold Snap* and *Never Ending Gale* are the crux of the Captain Scott story. Captain Scott's expedition meteorologist, Dr George C. Simpson, formulated what appeared to many as a conjecture that 1912 was an "abnormal year". However, Dr Simpson's 1912 'abnormal year' was (and is) merely a conjecture, which is a testable statement based on meteorological records. In this chapter, by using Captain Scott's original (which

Dr Simpson used) meteorological records of the *Terra Nova* and *Discovery Expeditions*, as well as Lt Shackleton's *Nimrod Expedition*, I will prove that 1912 was a year not deviating from previous records. Thus, the only idiosyncrasy[8] was Dr Simpson's counterfactual hypothesis, his tantamount of the weather climate, and controlled participation in a tacit agreement to promote Captain Scott's reputation.

Dr Simpson's conundrum with locutions like "abnormal year," since its formulation in 1919[9] played a *res judicata* (a matter [already] judged) role in the historical scrutiny of Captain Scott's story.

Within this chapter, for the reader as well as for the author, it is principally important to be able to distinguish meteorological knowledge of an area immediately before and during the *Terra Nova Expedition*, and the knowledge gained after the expedition, including hindsight views and interpretation.

3.1. Weather *vs.* Climate

Climate is what we expect,
weather is what we get

Robert Heinlein[10]

At the time of actual events in Antarctica, as well as when Dr Simpson went over Captain Scott's expedition records, he was dealing not only with a collection of digits (temperature, pressure, *etc.*), but also and with fundamental questions of weather vs. climate. This question is not only fundamental from a meteorological point of view, but also from a physical description of nature. The question is related to the issue of how precisely one can describe natural phenomena by using a few or an entire ensemble of meteorological variables. This question has a double significance. The first is physical, and the second psychological, in many cases acutely more important than the first one.

Unfortunately, for Dr Simpson, who in 1920 succeeded Sir William Napier Shaw as Director of the Meteorological Office, London, there was no difference between the weather and climate, at least in Dr Simpson's analysis of the meteorology of the *Terra Nova Expedition*.

In Chapter 1, I have reanalyzed Dr Simpson's gustiness of the coefficient of winds observed at Cape Evans. It was shown there that the nature of wind events at various locations at Ross Island was a self-organized criticality. This fundamental wind behavior was found to hold for all winds events across the Antarctic continent, including the valleys discovered by Captain Scott – the now famous McMurdo Dry Valleys.

More precisely, the snowless Dry Valleys, surrounded by endless fields of snow/ice, are a complete and precise example of land formation directly reflecting the local climate surrounded by the general Antarctic continental climate. For an observer stationed at these valleys, it is unimaginable that just a few miles away in any arbitrary direction, the land and the ocean are covered by ubiquitous thick snow/ice.

Although Vilhjalmur Stefansson divided the history of Arctic exploration into four distinct periods related to different methods of transportation, one could examine it as a continuous progress in understanding and extremities of polar climate.

Just by looking at the fauna and flora at the given location, one can arrive at an educated guess as regard to the site's climate. It was accepted long before Dr Simpson performed his analysis of the *Terra Nova Expedition* meteorological records that the weather cannot be understood as a climate and *vice versa*.

The already mentioned Sir William Napier Shaw, in the first volume of his four-volume work on meteorology, gives the following account in Chapter XIII, titled *The Development of Arithmetical and Graphical Manipulation*[11]

> Thus in the development of the science of statistics as applied to meteorology in the course of the last thirty-five years we have to notice the development of a new terminology which was not necessary for the treatment of errors of observation. The arithmetic mean is not always the most plausible value of a definite physical quantity but itself creates a new idea of mean value which may be applied to any collection of observations of the same element, mean daily temperature, mean range of temperature, and so on. When the observations extend over a series of years the mean value becomes the normal with the understanding that the same period of years shall be used for the observations from a whole group of stations. Thus thirty-five years is regarded as being a suitable period for normals [*sic*] of rainfall in view of the cycle of thirty-five years suggested by Brückner. But that is only a temporary understanding depending on the fact that organised series of observations do not as a rule extend beyond that limit. The true idea of a normal for a period of years is that the mean value for every period of the same length of a very long series would give the normal and that necessarily would imply perfect recurrence at the completion of the period.

In modern terms, *climate* is understood as statistical weather information that describes the variation of weather at a given place(s) for a specified long time ensemble average. Ensemble averages assume long-term, quasi-stationary states which we call climate. In fact, it assumes that the variation of the weather, defined as a minute state (short term) of meteorological variables (sunshine, rain, cloud cover, winds, hail, snow, sleet, freezing rain, flooding, blizzards, ice storms, thunderstorms, and more), is converging into a long-term climatic average – climatology.

In Chapter 1, I have briefly addressed the question of calculating averages of meteorological variables like wind velocity, temperature, pressure, *etc.* It was shown there that without knowing the mathematical properties of underlining distribution functions of meteorological variables, it is erroneous to calculate its average (climatological) value as this calculation may be affected by an *ill-defined* problem.

In order to obtain a true (climatological) distribution function of given meteorological variables, one has to measure and collect a large set of data. The law of large numbers tells us that the larger the number of repetitions (measurements), the better the approximation of the distribution functions tends to be – probability as the long-run relative frequency of an event's occurrence.

Thus – as Sir William Napier pointed out above – thirty-five years is regarded as being a suitable period for "normals" or climatological averages. Indeed, thirty-five years is a long period of time, and certainly no nineteen and early twentieth-century expeditions to the Arctic and Antarctica remained there for such a long time.

Therefore their records, cannot be regarded as a record suitable for climatological reasoning. When the weather has been observed for a sufficiently long time in any locality, we are able to make a useful statement as to the weather which may be experienced at any particular time of the year in that locality. However, based on short historical records, the range of these fluctuations is unknown, and thus the range of variability of meteorological variables is also undefined.

Shortly, I will support this notion by using modern temperature records, but before that, let us briefly stop and look again at the wind data collected and analyzed by Dr Simpson and Charles Wright. Complete meteorological records of the *Terra Nova Expedition* were later compiled in Dr Simpson's three volume summary. However, long before the summary was printed, Dr Simpson was asked by Leonard Huxley to prepare a tentative expedition meteorological report to be published in the second volume accompanying the first volume of Captain Scott's Journal.

This second volume, after its original publication was never to my knowledge reprinted in other editions, despite that in addition to brief scientific commentaries, it also contains field accounts of various parties.

In his chapter, Dr Simpson makes a high appraisal of his own and Wright's meteorological work[12]

> The following short statement of work done at Cape Evans will give some idea of the completeness of the outfit:
> (a) An almost unbroken record by self-registering instruments of: temperature (two instruments), barometric pressure, wind force (two instruments), wind direction, sunshine, electrical state of the atmosphere, and the three elements of terrestrial magnetism,
> (b) Regular observations of the usual meteorological instruments,
> (c) An investigation of the upper air by means of balloons both with and without instruments, by which knowledge has been gained of the temperature and air currents up to a height of over five miles.

It is indeed a fine meteorological record; however, Dr Simpson does not explain why the record ends in August (temperature) and September (wind) of 1912, and does not resume until the arrival of *Terra Nova* on Jan. 18th, 1913 at Cape Evans.

While writing his chapter for the expedition's second volume in 1913, Dr Simpson had already made a tacit agreement with members of the expedition to uphold Captain Scott's reputation. In the case of Dr Simpson, the promotion of the leader's standing was based on creating a crucible of counterfactuals and irreconcilable contradictions – provided that the reader did not study meteorological records of the expedition in more detail.

Dr Simpson was direct about the aim of his chapter[13]

> Those who, previous to reading this book, have read Amundsen's 'South Pole' cannot but have been struck by the fact that while this book is full of descriptions and references to blizzards the word hardly appears in the other. It is very natural to ask the reason for this strange difference. The reason is an important one, and if it had been known previously the history of the conquest of the South Pole would have been very different. *One can now say definitely that the blizzards which have been so fateful to British Antarctic*

> *exploration are local winds confined to the western half of the Ross Barrier.* [emphasis original]

Dr Simpson's estimate of the situation related to blizzards is loaded with implicit assumptions and not confirmed by data analysis inferences.

The first and central figure in Dr Simpson's false reasoning is a lack of a definition of a blizzard that was commonly accepted by Captain Amundsen, Captain Scott, and other explorers.[14] Without going into the meteorological data of both expeditions, one could observe that this alone could lead to a fuzzy account of blizzard events and thus for a non-uniform account.

Not every wind event leads to a blizzard; however, every blizzard is driven by a wind event. A ground blizzard has snowdrifts and blowing snow near the surface. Therefore, one just by looking at printed wind velocity records cannot make a reasonable judgment about blizzard conditions, and *in situ* observations by an observer are essential.

Having this in mind, we can look back again at the ranking of the word *blizzard* in narratives of different Antarctic expeditions, as shown in Tab. 2.1. Indeed, the ranking of the word blizzard is much higher in Captain Scott's *Terra Nova* narrative then in Captain Amundsen's account.

Dr Simpson concludes that "if it had been known previously [the difference in blizzard occurrences – KS] the history of the conquest of the South Pole would have been very different". One can presume that Dr Simpson is suggesting that if it was known that the Cape Evans location and the western half of the Ross Barrier is battered by blizzards in an extraordinary way, Captain Scott would have chosen a different landing location – the Bay of Whales perhaps?

However, by comparing the respective ranking of the word blizzard during Captain Scott's *Discovery Expedition* and Lt Shackleton's *Nimrod Expedition*, one can observe that if Captain Scott read Lt Shackleton's diary carefully, he could observe its high word rank and thus high frequency. But then, from what source could anyone know that the eastern part of the Barrier was more traversable and windless? Did Captain Amundsen and Captain Scott record climatology, or only the weather during their respective journeys? Besides, I do not think that it ever crossed Captain Scott's mind to not land and establish the *Terra Nova Expedition* base camp on the shores of Ross Island.

In order to substantiate his assessment resulting from *in situ* visual and verbal accounts of blizzards, Dr Simpson presented an analysis of *automated records* of the wind obtained at Cape Evans, and compared it with similar observations at Framheim and the Yarmouth station on the Isle of Wight. His results are reproduced on Fig. 3.1.

By comparing wind frequency curves (see Fig. 3.1), Dr Simpson concludes without providing a reason that "the wind conditions shown in the Framheim curve are the ideal ones for Polar work". But then, if the wind behavior at the Framheim location is ideal, and *if* "there was nothing abnormal [*sic*] in the region in which Cape Evans was situated,"[15] the wind frequency curve at Cape Evans should follow the dotted line, as indicated at Fig. 3.1.

However, this is not the case, and according to Dr Simpson, the "shape of the curve indicates that there is some factor affecting the winds at Cape Evans which is not present at a normal station [Framheim – *sic*]." What factor is the likely culprit for this deviation from ideal behavior?

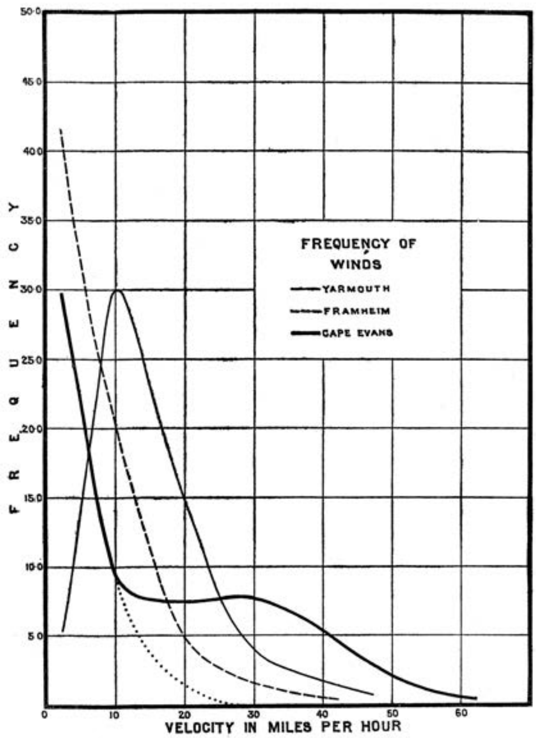


Figure 3.1. Reproduction of Dr Simpson's original figure[1] depicting frequency of winds vs. wind velocity at various locations: Yarmouth (Isle of Wight) – thin solid line, Framheim – broken line, and Cape Evans – thick solid line. Wind frequency was calculated by dividing wind velocity into rather wide 5 miles per hour segments.

[1] Robert F. Scott, *Scott's Last Expedition: Being the Reports of the Journeys & the Scientific Work Undertaken by* Dr. *E. A. Wilson and the Surviving Members of the Expedition*, Vol. II, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 466.

For Dr Simpson, the answer is indeed simple[16]

> This factor is the blizzard. Superimposed upon the normal [*sic*] winds … Thus the shape of the wind curve for Cape Evans shows clearly that the blizzard is an abnormal phenomenon [*sic*] superposed upon the ordinary meteorological conditions

However, I disagree with Dr Simpson's analysis and "abnormal" interpretation of wind frequency at Cape Evans. My disagreement is valid on two counts. The first is a statistical argument, and the second objection is based on the indistinguishability of wind events and blizzards. It is the first time when Dr Simpson presents counterfactual thinking containing an antecedent and a consequence in relation to meteorological records.

Due to a lack of a clear definition of a blizzard, the *in situ* accounts of Captain Scott and Captain Amundsen may substantially differ, because the notion of a blizzard event was not detached from subjective personal assessment. A similar comment

may be also applicable to wind velocity estimation by using the subjective Beaufort scale, especially in the featureless Antarctic "ice/snowscape", though previous experience on the sea provides good guidance.

In his calculations, Dr Simpson used "continuous automatic record(s) of the wind"[17] at Cape Evans obtained by using a self-registering wind vane anemometer.[18] Certain important information is missing, and in Dr Simpson's own description[19]

> The self-registering wind vane was not entirely satisfactory as it did not turn very freely and the time scale was so small that it was difficult to fix with accuracy the time when the wind changed.

Therefore, just by only looking and analyzing automatic records, there is no way to propose deterministic identifiability and distinguishability methods to differentiate blizzards and wind events, respectively. First, the observer would need to open the window or the door of Captain Scott's hut at Cape Evans and make simultaneous visual inspections of outside conditions.

Additionally, the wind vane's recording threshold is unknown. Most importantly, Dr Simpson did not inform us of the length of wind records that was included in his calculations. The last information is fundamentally (statistically) crucial in obtaining an accurate account of wind events.

On Fig. 3.2, I depicted Dr Simpson's Cape Evans[20] wind data together with Captain Amundsen's,[21] and modern wind data recorded at Scott Base. The entire range of wind velocities was divided into the same segments as in Dr Simpson's original figure. Additionally, the wind events frequency was normalized to one (1) to show possible differences in wind event counts at Cape Evans and modern data.

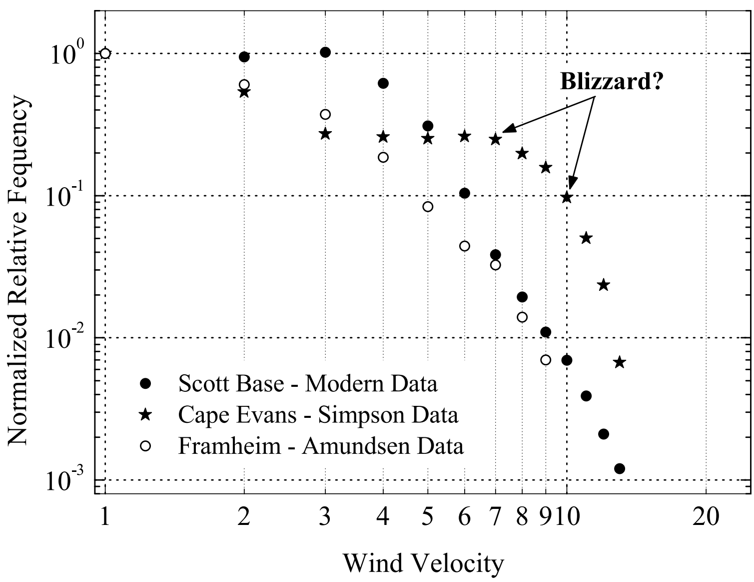


Figure 3.2. Normalized relative frequency of wind velocity at different meteorological stations: Scott Base, Cape Evans, and Framheim. The wind velocity is given in miles per hour and 1 = from 0 to 4 miles/h, 2 = from 5 to 9 miles/h, and so on.

It is evident from this figure that both Cape Evans and the Framheim wind data differ substantially from modern data (1996–2010). The difference concerns the number of particular wind events (within a given range of wind velocities – see Fig. 3.2 caption) measured during the historic time in comparison with modern data. The difference is also clearly visible for Cape Evans, where a pronounced hump appears. Dr Simpson attributed its appearance to “the blizzard [which] is an abnormal phenomenon superposed upon the ordinary meteorological conditions.”

Surprisingly, the “abnormal phenomenon” (blizzard) reported by Dr Simpson is not observed on the respective curves representing modern wind data collected at the Scott Base weather station. Did abnormal phenomena disappear from shores of the Ross Island within the last century? Was it *El Niño/La Niña* – Southern Oscillation and/or the global warming effect?

Using Occam’s razor and reading the book *The Complete Idiot’s Guide to Statistics*, or even simply recasting Dr Simpson’s plot, enables one to find the correct answer. The law of large numbers tells us that a large sample from a given population will have a distribution function that will resemble the overall distribution.

Alternatively, by drawing from a large sample an ever increasing number of its population, the distribution function of the sample will become a better and better approximation of a population distribution function. One observes what mathematicians call convergence in distribution.

On Fig. 3.3, I depicted a number of wind events occurrences vs. wind velocity for Cape Evans, Framheim, and Scott Base. For the last station and for the period of 1996–2010, the total number of wind events with wind velocity between 0 and 4 miles/h is close to 180000, which is *much* greater than a similar count of wind events

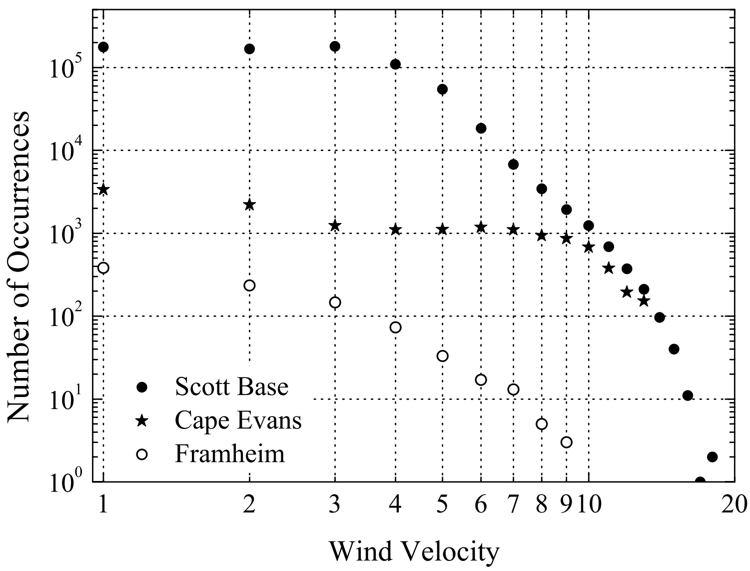


Figure 3.3. Number of occurrences of wind events *vs.* wind velocity at Scott Base, Cape Evans, and Framheim. The wind velocity is given in miles per hour and 1 = from 0 to 4 miles/h, 2 = from 5 to 9 miles/h, and so on.

at Cape Evans (3357) and Framheim (385). Thus, historic wind data occurrences (events) for wind velocities for interval 1 = 0 to 4 miles/h, as depicted on Fig. 3.3, represents a tiny amount (about 2% at Cape Evans), and if similar records existed, 0.2% (at Framheim) of modern data.

The way how Dr Simpson chose to present his wind data, especially the selection of a wide range of wind velocities, every 5 miles/h, requires a more careful statistical analysis of the *Terra Nova Expedition* wind record at Cape Evans. However, modern wind data from nearby weather stations at McMurdo and Scott Base are sufficient to shown that the wind events at these locations and across the Antarctic continent follow, as I have shown in section 1.4, a self-organized similarity, described by a power-law probability distribution function, which does not have a hump as depicted by Dr Simpson on Fig. 3.2. Combined with the fact that Dr Simpson used automated records in wind velocity analysis, as briefly discussed above, one has to conclude that his conjecture about "the blizzard [which] is an abnormal phenomenon superposed upon the ordinary meteorological conditions." is entirely unfounded.

We will see later in this chapter that Dr Simpson was prone to use the word *abnormal* in different instances where he could not find an answer, or where he wanted to direct the readers. Thus Captain Scott's quarters were exposed and battered by "*abnormal*" weather phenomena, on the contrary to Captain Amundsen's Framheim, which was ruled "*normal*".

In order to be meticulous and avoid presentism, I looked into the meaning of word *abnormal* in Webster's International Dictionary published in 1907. It defines the word as "Not conformed to rule or system; deviating from the type; anomalous; irregular"[22]. This definition is similar to today's meaning as a "deviating from the normal or average".

3.1.1. Daily and Annual Variation of Temperature

The knowledge of the daily and annual variation of temperatures at Cape Evans and especially at the Ross Ice Shelf and further toward the Pole was from a logistical point of view a *primary* concern for Captain Scott, and the chief meteorologist of the expedition, Dr Simpson.

Upon arriving at Antarctica, Captain Scott would have had *weather* records for the Ross Island and western part of Barrier from his own *Discovery Expedition* (1901–1904) and from Lt Shackleton's *Nimrod Expedition* (1907–1909). Since Lt Shackleton's meteorological data was published after 1930 (see Tab. 1.1), Captain Scott and Dr Simpson had a *very* limited weather record. To my knowledge, both Captain Scott and Dr Simpson did not have access to the meteorological data later published in 1930 by Dr Kidson.[23]

Admittedly, some sparse meteorological data was available from Lt Shackleton's book,[24] including limited data from the South Pole journey. Captain Scott had very little to guide him. Certainly, Lt Shackleton's record was a weather record, thus only a coarse indicator of climatological data.

It is important to stress that in meteorological analysis one should beware of possible cognitive biases:

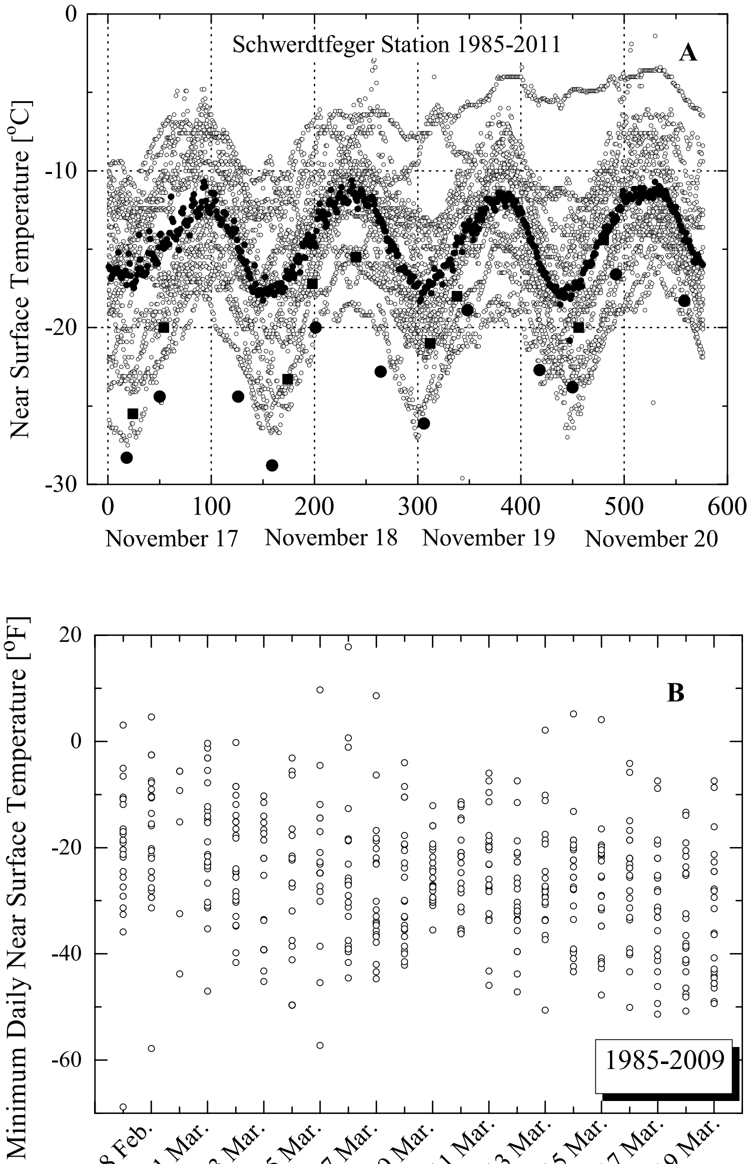


Figure 3.4. **A** – Comparison of daily temperatures (open circles, ○) recorded at Schwerdtfeger weather station from Nov. 17th through 20th, during the years 1985–2011, with the historical temperature records of Lt Bowers (●) and Meares (■) during the same dates, but in 1911. The mathematical average temperature (1985–2011) is shown by small solid black circles (•). The time of each day is divided by 144 into 10-minute intervals. **B** – The minimum near surface air temperatures recorded at Schwerdtfeger weather station during the 1985–2009 period

- hindsight bias – the tendency to see past events as being predictable,
- weather vs. climate bias – belief that a sample's average must equal its expected value,
- law of averages bias – belief that an event is *due* to happen.

In the case of the permanent meteorological station at Cape Evans, temperature measurements were recorded every hour for a 24h period, and according to Dr Simpson, this was satisfactory to calculate the daily mean temperature. In the case of sledging parties taking temperature records frequently, this would have significantly impeded daily marches, and instead[25] observations were taken in the morning, near mid-day, and in the evening.

Dr Simpson was concerned (without a specific argument) in calculating and discussing daily mean temperatures at the Barrier, and he observed that[26]

> The daily range of the temperature on the Barrier is so great that the mean temperatures cannot be obtained from simple temperature observations taken two or three times a day, for the time at which the observations are taken makes a very large difference in the temperatures recorded. The following example will illustrate this and will serve to show how the mean temperatures on the Barrier were obtained.

To illustrate the difficulty, and as one may think for the moment, to understand possible the weather vs. climate bias analysis, Dr Simpson notices that the difference between average temperature (*three* observations) obtained from Bowers (–9.3°F) and Meares (–1.5°F) recorded between Nov. 17th through 20th in proximity of One Ton Depôt (today's weather station named Schwerdtfeger Station), 1911 is about eight degrees Fahrenheit.

By plotting temperatures vs. time recorded by both parties Dr Simpson noticed the "imperative necessity of taking the minimum temperature into account in calculating the mean temperature on the Barrier".[27] By adding a fourth temperature record, minimum *night* temperature, Dr Simpson concluded that he was able to obtain an accurate account for mean daily temperature. "Nearly all the temperature observations made on sledge journeys have, therefore, been plotted and the mean daily temperatures determined by reading the curve at four-hourly intervals."

Before proceeding with a critical examination of annual variation of mean temperatures at the Ross Ice Shelf, let me pause and compare Dr Simpson's estimates with modern temperature records. On Fig. 3.4-A, I depicted near surface temperatures recorded at Schwerdtfeger Weather Station (1985–2011), which is located 17.1 miles south from One Ton Depôt, where, as mentioned above, temperature measurements were recorded by Bowers and Meares, and subsequently analyzed by Dr Simpson. The historical Nov. 17th through 20th, 1911 data is also depicted on this same figure.

On this figure, open circles represent temperature records measured at 10 minute intervals,[28] while solid black circles represent mathematical average temperatures calculated also at the same time and time intervals. Provided that modern records represent 26 years of data collection, one could reasonably say that what is presented on Fig. 3.4-A is averaged near surface temperature (black circles), as well as the range of minute temperatures variations presented by climatological data.

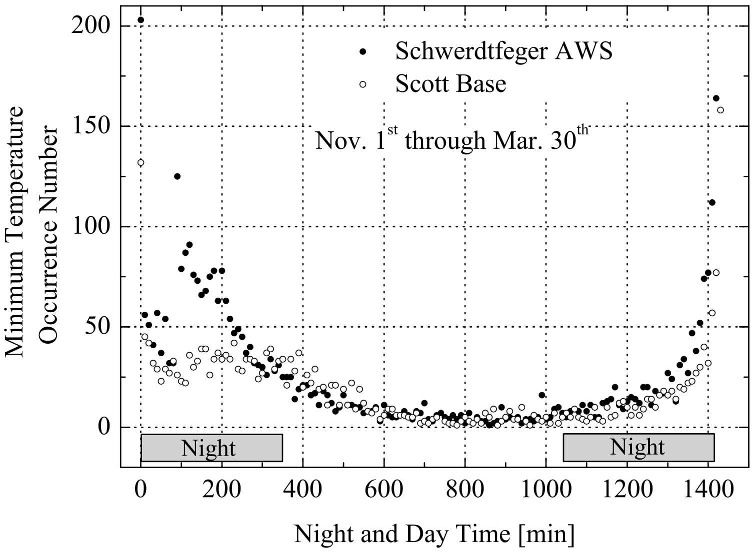


Figure 3.5. Occurrence of *daily* (within a 24h period) near surface minimum temperatures at Schwerdtfeger (solid circles) and Scott Base (open circles) weather stations during the period Nov. 1st through Mar 30th. The approximate night time from 6 p.m. until 6 a.m. (New Zealand Standard Time – NZST) is also indicated.

The inquisitive reader readily notices from this figure (Fig. 3.4), that temperatures measured by Bowers and Meares remain in the lower part of long term (climatological) observations. Additionally and more importantly, the average temperature, even with Dr Simpson's inclusion of minimum temperature, is *much* lower than the climatological average obtained for modern data. This clearly shows how weather vs. climate biased Dr Simpson's reasoning was.

The climatological average of daily temperatures recorded at Schwerdtfeger Weather Station, as depicted in Fig. 3.4-A, can be approximated by a combination of trigonometric functions (sine and cosine) with its minimum indicating the lowest daily temperatures (minimum daily temperature) around midnight. Certainly this is the case if one speaks about a climatological average. The averaging procedure, however, removes (flattens) all temporary temperature fluctuations which, as shown on Fig. 3.4-B, are significant and cover a wide range of temperature fluctuations.

The range of these fluctuations is well illustrated by a plot of *daily* (within a 24h period) near surface minimum temperature occurrences, as depicted on Fig. 3.5. This particular figure has multiple consequences in my analysis of Captain Scott's *Terra Nova Expedition*. It reveals transportation complexity issues, which in different degrees worried all polar explorers, including Captain Scott and Captain Amundsen. I will discuss these issues in the next sections of this chapter. Right now, let me finish with comments about what was known before the *Terra Nova Expedition* about annual temperature changes at various Ross Island locations and at the Barrier.

Essentially up to 1909, the summary of temperature records at various locations in Antarctica was presented by James Murray in the second volume of Lt Shackleton's account of the *Nimrod Expedition*. His summary is reproduced on Fig. 3.6.

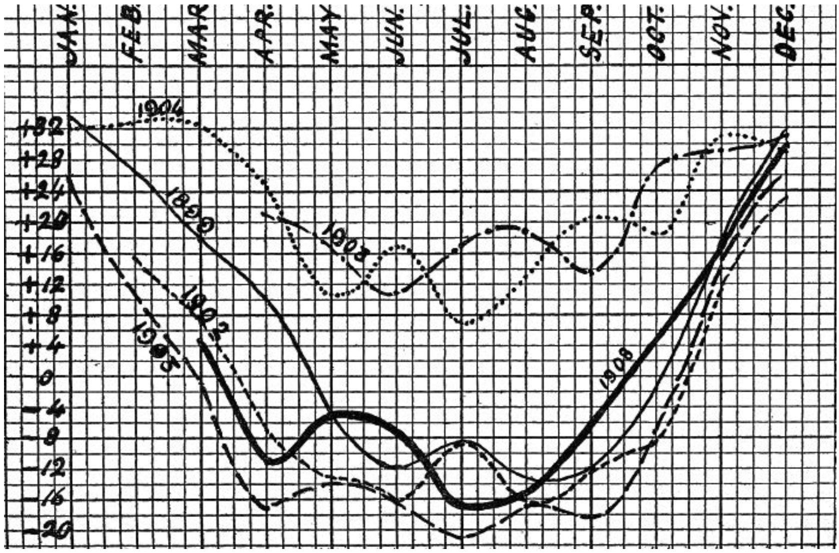


Figure 3.6.[1] "The months read from left to right, and the temperatures, in degrees Fahrenheit, from above downwards. The two uppermost curves are Dr. Bruce's records (Scotia expedition) dot and dash. = his first year (1903), dots . . . .= his second year (1904). The thin plain line = Borchgrevink record (1899) (This curve is taken from Mr. Armitage book.) The short dashes = the Discovery records for the first year (1902), the long dashes = the second year (1903). The thick solid line represents the temperature record of Lt Shackleton's *Nimrod Expedition*."

[1] Ernest Shackleton, *The Heart of the Antarctic, Being the Story of the British Antarctic Expedition, 1907–1909*, Vol. I & II, W. Heinemann, London, 1909,. Nimrod, Vol. II, *cf.* p. 387.

From Captain Scott's point of view, only two records mattered: his own from the *Discovery Expedition* (1901–1904), and Lt Shackleton's record collected during the *Nimrod Expedition* (1907–1909).

Indeed, it was just a *weather* record. Provided that the full record of the Lt Shackleton expedition was published many years after the *Terra Nova Expedition*, Captain Scott and Dr Simpson would have had an extremely limited weather record collected at Hut Point.

In addition to the Hut Point temperature record of the *Discovery Expedition*, twenty-four temperature records were collected during various sledge journeys, including Captain Scott, Dr Wilson, and Lt Shackleton's journey to the South.

Despite that, Captain Scott and Captain Amundsen did not have meteorological data to make climatological evaluations of the weather during their expeditions. Therefore, all generalizations concerning observed weather were unfounded claims and unscientific generalizations. Except for some weather "data" collected by Carsten Borchgrevink (Feb. 16th, 1900) and Lt Shackleton (Jan. 24th, 1908), Captain

Amundsen did not have any meteorological record at his disposal before landing at the Bay of Whales.

Returning briefly to Tab. 2.1, which compares Captain Scott's narrative during his two expeditions, one can observe a significant shift in rank for weather-related words. During the *Terra Nova Expedition*, Captain Scott was more prone to use weather generalizations by using weather-related words compared to his *Discovery Expedition*. At many instances, Captain Scott, while addressing the weather issues, was grossly confusing it with climate and with his real knowledge of it. It would be uninteresting to pick every instance, but I will just mention a few

> Nov. 28th, 1911: "This has certainly been the most unexpected [*sic*] and trying summer blizzard yet experienced in this region. ",
> Dec. 3rd, 1911: "Our luck in weather is preposterous",
> Dec. 4th, 1911: "it makes me feel a little bitter to contrast such weather with that experienced by our predecessors."
> Dec. 16th, 1911: "We are now 6 days behind Shackleton, all due to that wretched storm.",

However, the most glaring confusion of weather with climate appeared in Captain Scott's *Message to the Public* where he is referring to the February 27th through March 19th, 1912 – *Extreme Cold Snap*[29] – which struck the party in the middle of the Ross Ice Shelf

> … no one in the world would have expected the temperatures and surfaces which we have encountered at this time of the year.

However, if one remembers that before and long after Captain Scott, there was nobody there in the middle of the Barrier in late February, the question of what "expected" temperature might be expected there is indeed foolhardy. Captain Scott did not have prior evidence and/or data to make the above *conjecture* of unexpected low temperatures.

In the last sentence, I deliberately used the word *conjecture* in relation to Captain Scott assessment of "temperatures and surfaces" expectations. The term *conjecture* was introduced into scientific philosophy by Karl R. Popper.[30] A *conjecture* is a statement based on inconclusive (unproven) evidence but is thought to be true and has not been disproven.

Captain Scott's above conjecture represents reasoning that involves the formation of conclusions from incomplete evidence. *Inter alia* the aim of my book is to validate this conjecture by proving or disproving it.

3.1.2. Ubiquitous Friction

Friction is like gravity – a ubiquitous physical phenomenon.[31] It was Leonardo da Vinci who proposed the basic laws of intrinsic friction by assuming the directly proportional relation, $F \propto P$ where the bonding force of friction is F and the normal force P (occasionally denoted P_N). In the most simple and educational case of perpendicular surfaces at contact, normal force is $P = mg$, where m is the mass of the object and g is

the gravitational field strength (about 9.8[m/s^2]). The equation relating friction and normal force has a well known and simple form[32]

$$F = \mu P,$$

where μ (*Mu*) is the coefficient of friction[33]

> The numerical coefficient μ, which is called the *coefficient of friction*, depends, as has been said, upon the nature of the surfaces which are in contact. Experience has shown also that it has different values for the cases of rest and motion. The force with which a rough surface resists the commencement of motion is, *cæteris paribus* [*sic*], greater than that with which it resists the *continuance* of motion once commenced. Hence, in as much as the force is in both cases represented by μP, it is evident that it must be greater when the particle is at rest than when it is in motion. This is expressed by saying that the *coefficient of statical friction is greater than the coefficient of dynamical friction*.

Before reviewing the influence of temperature on sledging efficiency, let me look at another elementary issue of energy (work) needed to drag a sledge with a given net weight. My interest in this question results from the well-known fact that Captain Scott halted at the moraines of the Beardmore Glacier to collect geological specimens. Dr Atkinson, in his *The Finding of the Dead* appendix published in the 1913 edition of Captain Scott's journals, came to an unsupported conjecture of the importance of the collected specimens[34]

> We recovered all their gear and dug out the sledge with their belongings on it. Amongst these were 35 lbs. of very important [*sic*][35] geological specimens which had been collected on the moraines of the Beardmore Glacier; at Doctor Wilson's request they had stuck to these up to the very end, even when disaster stared them in the face and they knew that the specimens were so much weight added to what they had to pull.

However, it was Cherry-Garrard who once again walked into the scientific domain of arguments by justifying (explaining) Captain Scott and his party's actions. An over-confident Cherry-Garrard took aim at critics[36]

> The practical man of the world has plenty of criticism of the way things were done. He says dogs should have been taken; but he does not show how they could have been got up and down the Beardmore [*sic* – see Scott[37]]. He is scandalized because 30 lbs. [*sic* – Dr Atkinson gives 35 lbs.] of geological specimens were deliberately added to the weight of the sledge that was dragging the life out of the men who had to haul it; but he does not realize that it is the friction surfaces of the snow on the runners which mattered and not the dead weight [*sic*], which in this case was almost negligible [*sic*].

If Cherry-Garrard at the time of his book writing consulted not only George Bernard Shaw,[38] but also any British teacher of basic science, then he could learn that the dead weight of the sledge matters, as per the above mentioned equation discovered by Leonardo da Vinci. This elementary fact was described in a few hundred books on mechanics published well before Cherry-Garrard came up with his revelations.[39]

In the second volume of Cherry-Garrard's book *The Worst Journey in the World*, one can find a small section titled *Note*, where the author acknowledges his general understanding of friction on the sledging process.[40] Apparently, Cherry-Garrard, after returning from Antarctica, consulted Dr Nansen on general questions of sledging.[41] Therefore, it appears that Cherry-Garrard produced his revelation concerning the lack of dead weight influence on sledging efficiency to cover up Captain Scott's seemingly extreme and deadly decision of collecting and dragging specimens from the moraines of the Beardmore Glacier (see also subsection 11.1.11).

The net force $\left(F_{\text{net}}\right)$ *causing sledge movement* is a simple difference between applied force by the pulling party $\left(F_{\text{app}}\right)$ and friction force (F) given by the equation,

$$F_{net} = F_{app} - F = F_{app} - \mu P = F_{app} - \mu mg,$$

where normal force is $\mathrm{P} = \mathrm{mg}$ where *m* is *the mass* of the sledge with its load or the *dead weight*, as Cherry-Garrard called it.

In view of the above elementary physical formulation of friction law, as well as elementary field experience of *many* people, but on the contrary to Cherry-Garrard's false assessment, the weight of the sledge and its load (the dead weight) *matters* in sledge movement. To say to the contrary is to ignore elementary knowledge, but also to disregard field knowledge gathered by Arctic explorers who sledged with their dead weight for a combined many thousands of miles.

In order to figure out the ratio of distances $\left(\Delta d\right)$ travelled with the change of the dead weight of the sledge and its load, it is one more time useful to make the *cæteris paribus* assumption that all physical variables (friction, daily sledging energy expenditure, *etc.*) are unchanged, and *only* the dead weight of the sledge with its load is variable.

Under this assumption, one can obtain the simple formula

$$\Delta d = \frac{1}{F_{app-\mu mg}}\left(F_{app} - \mu mg \cdot x\right),$$

where x is the ratio of actual and initial dead weight of the sledge and its load. By changing the ratio of actual and initial dead weight (x) in the above formula, one can figure out the ratio of travelled distance $\left(\Delta d\right)$.

On Fig. 3.7, I depicted the ratio of travelled distance $\left(\Delta d\right)$ versus the ratio of actual and initial dead weight. The plot is only illustrative and obtained by assuming that $F_{app} = 2\mu mg$. The conclusions from this figure are rather palpable and expected. Increasing the dead weight leads to a linear *decrease* of distance travelled by the party. I did say linear decrease; however, due to the complexity of friction phenomena, one could expect a non-linear relationship. For my purpose, this linear (first) approximation is entirely sufficient.

On this figure, I indicated "expedition starting" point – coordinates {1, 1} – when the initial weight is equal to its accentual weight – ratio equal to one. Provided that every day energy expenditure of the sledging party is the same, one observes from Fig. 3.7 that due to consumption of daily rations, the dead weight will diminish and the party will *increase* its daily distances. Conversely, if the initial dead weight was increasing due to an unspecified reason, the daily distances covered by the party will *diminish*. All that is under the assumption of a constant daily energy expenditure by the party.

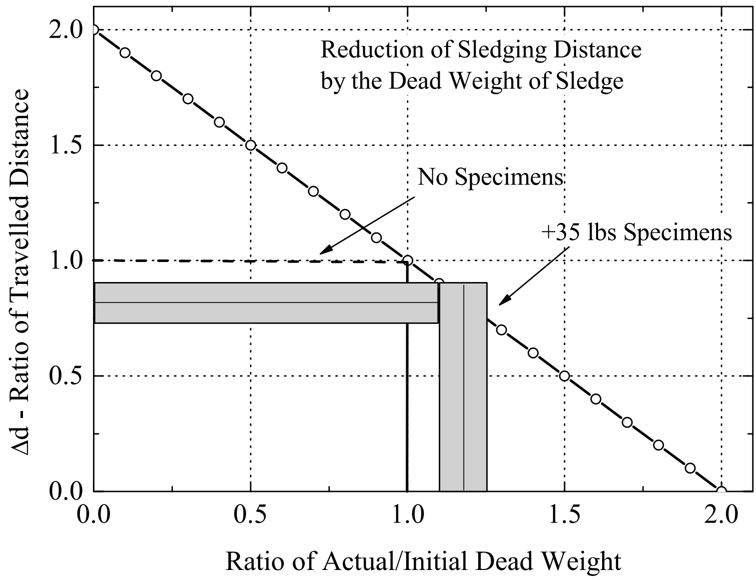


Figure 3.7. The ratio of travelled distance (Δd) versus the ratio of actual to initial dead weight of the sledge with its load. The plot was obtained under an illustrative assumption that $F_{app} = 2\mu mg$ (applied force by pulling party is twice as large as the friction force).

On Feb. 8th, 1912, the polar party approached the end of descent from the Beardmore Glacier and Captain Scott noted in his diary[42]

> We decided to steer for the moraine under Mt. Buckley and, pulling with crampons, we crossed some very irregular steep slopes with big crevasses and slid down towards the rocks. The moraine was obviously so interesting that when we had advanced some miles and got out of the wind, I decided to camp and spend the rest of the day geologising. It has been extremely interesting. We found ourselves under perpendicular cliffs of Beacon sandstone, weathering rapidly and carrying veritable coal seams. From the last Wilson, with his sharp eyes, has picked several plant impressions, the last a piece of coal with beautifully traced leaves in layers, also some excellently preserved impressions of thick stems, showing cellular structure. In one place we saw the cast of small waves on the sand. To-night Bill has got a specimen of limestone with archeocyathus-the trouble is one cannot imagine where the stone comes from; it is evidently rare, as few specimens occur in the moraine. There is a good deal of pure white quartz. Altogether we have had a most interesting afternoon, and the relief of being out of the wind and in a warmer temperature is inexpressible.

The next day, the Party marched "along the edge of moraine to the end of Mt. Buckley. Stopped and geologized. Dr Wilson got great find of vegetable impression in piece of limestone. Too tired to write geological notes."[43]

The Captain Scott party collected at the foot of Mt. Buckley, from various accounts, a total of 30 to 35 ℔ of geological specimens. The specimens were loaded on the sledge with the intention of dragging them back to Cape Evans.

The party reached Shambles Camp on Feb. 18th. From here on, the Captain Scott team travelled from depôt to depôt with minimum food and fuel rations. Provided the state of their clothing and sleeping bags as well as the continuous consumption of food and fuel (until the next depôt), it is difficult to make a precise estimation of what fraction of overall weight was increased by adding 30–35 ℔ of specimens. However, one can estimate a possible range to be somewhere between 0.9–0.75 of initial weight before collecting specimens.

By making the additional *cæteris paribus* assumption that during Captain Scott's journey from the foot of Beardmore Glacier toward the One Ton Depôt, all weather events and personal issues were the same, the party, by not carrying geological specimens, would gain somewhere between 23–63 extra miles. The conclusion is palpable: without carrying the geological specimens, Captain Scott would reach One Ton Depôt and beyond. But an even more important – and disturbing – inference is the opposite deduction that: Captain Scott carried these geological specimens with the knowledge that he would not reach One Ton Depôt (see aslo subsection 11.1.11).

The critical reader would say that the above is a pure author's speculation. However, it is not a meaningless speculation. Both the Captain Scott's and Captain Amundsen's expeditions were speculations about a great number of issues. For example, Captain Scott's assumption to run back and forth to the Pole in 144-days was pure speculation from every point of view. We do not know how Captain Scott arrived at this figure. All we know is that[44]

> The whole journey there and back is about 1,530 geographical miles, longer than any sledge journey ever yet made. Since Shackleton's figures are our best guide, I have laid these prospective plans upon data taken from his book … On this calculation the whole journey will be 137 days there and back to Bluff Depot, or 144 days back to C. Armitage … I wish to repeat now what I said when I first heard of the presence of Amundsen, that this Expedition is going to lay its plans and carry on with its work just as if Amundsen did not exist.

From his journal, one can easily learn that at many instances Captain Scott was making various projections and estimations of distance and time.

At least on Mar. 16th/17th, 1912 while keeping specimens Captain Scott decided to reduce the dead weight of sledge[45]

> We leave here our theodolite, a camera, and Oates' sleeping-bags. Diaries, &c, and geological specimens carried at Wilson's special request, will be found with us or on our sledge.

But it was too late and too little. Despite dumping certain items, Commander Evans was eager to observe later about Captain Scott's sledge[46]

> It seems to me extraordinary that in the face of such obstacles they stuck to all their records and specimens. We dumped ours at the first big check. I must say I considered the safety of my party before the value of the records and extra stores – not eatable.
>
> Apparently Scott did not. His sledge contained 150 lbs of trash. He ought to have left it, pushed on & recovered the specimens & records this year.

The following hard questions remain open:

- Why did the Party not deposit in a well-marked location (and carry a note detailing the location of) the specimens to be recovered the next season by dog team(s)?
- Why, out of 30–35 ℔ of specimens, did Dr Wilson and Captain Scott not select a few of the most important samples and carry them on, while the rest were deposited?
- Why, by carrying geological specimens, did Captain Scott mortally risk his and his team member's lives?
- Why did Captain Scott use utilitarianism[47] to dogs and use a utilitarian[48] approach to members of his team?
- Is science and scientific discovery/knowledge more important than human life?
- On what basis did Dr Wilson judge that the specimens were important enough to take along?
- Can anyone sacrifice human life to gain scientific knowledge?
- Is human suffering and ultimately death worth it for progress in science?

Not only did Captain Scott follow in the footsteps of Lt Shackleton during his *Nimrod Expedition*, but Lt Shackleton also found specimens about 40 miles south (–84.967) from Lt Shackleton's geological site (–84.283)[49]

> The main rocks of the "Cloud-Maker," the mountain, under which we are camped, appear to be slates, reef-quartz and a very hard, dark brown rock, the name of which I do not know. The erratics of marble, conglomerate and breccia are beautiful, showing a great mass of wonderful colours, but these rocks we cannot take away. We can only take with us small specimens of the main rocks, as weight is of importance to us, and from these small specimens the geologists must determine the general character of the land.

However, contrary to Captain Scott, Lt Shackleton acknowledged the importance of sledge weight, and did not load excessive pounds of useless weight. Providing the circumstances of both teams, it would have sufficed, for scientific discovery, to bring back only one representative specimen.

A few days later, on Dec. 11th, 1908, Lt Shackleton "found rock there with what looked like plant impressions [*sic*]" and "collected some specimens." For a number of reasons (scientific and otherwise), Lt Shackleton understood the importance of collected specimens, and towards the end of his nearly fatal return from the South Pole journey, he commented on Feb. 5th, 1909 "Too weak on half ration to write much. Still hanging on to geological specimens. Please God we will get through all right. Great anxiety."[50]

I could not determine the weight of Lt Shackleton's geological specimens. In the case of Captain Amundsen, the weight of the sledge did not matter as much as in the case of British explorers. However, even "Roald Amundsen himself brought back altogether about twenty [*sic*] specimens of various kinds of rock from Mount Betty, which lies at latitude 85°8′S."[51] Unfortunately, Captain Amundsen's specimens did not contain plant imprints. However, they were quite useful nonetheless[52]

> This list of the most important rocks belonging to the foundation series of the parts of South Victoria Land already explored agrees so closely with the

rocks from Mount Betty and Scott's Noatak, that there can be no doubt that the latter also belong to the foundation rocks.

Up to now, I have been concerned about the dead weight of a sledge, with its load with friction and energy expenditure required for the sledding process. Indeed, the whole history of polar exploration is underlined by the quest, contrary to Cherry-Garrard's false and distracting notion, of cutting down of the weight of non-consumable items.

There has been a long history of interest in understanding snow friction and the basic physical processes by which sledge runners move over snow/ice. The tacit knowledge of northerly indigenous people and polar explorers, combined with scientific research, revealed a great number of factors which control and influence snow friction. Several dozen factors and physical processes have been attributed to snow/ice friction. I will not review these factors, but instead I will examine the verifiable temperature dependence of the kinetic friction coefficient, which is directly related to general sledding conditions.

If we assume that the near surface air temperature is varying slowly, then one can expect that the surface layer of snow/ice has a similar temperature. The following snow properties are important for runner sliding friction:

- temperature,
- hardness,
- bearing strength,
- wetness,
- grain size.

Let us look more carefully at Fig. 3.8, showing the temperature dependence of the snow friction coefficient. Even a cursory examination of this figure tells us what was known to native northern people and polar explorers. The friction coefficient

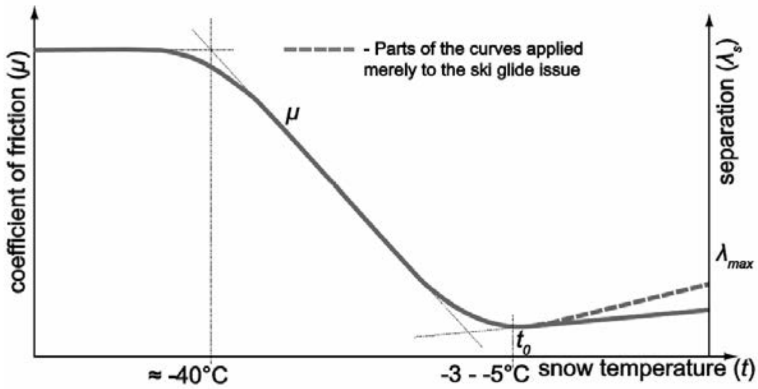


Figure 3.8. Friction coefficient (μ) of ski (sledge runner) versus snow temperature.[1]

[1] Adopted from the Ph. D. thesis of Leonid Kuzmin, *Interfacial Kinetic Ski Friction*, submitted to Department of Engineering and Sustainable Development, Mid Sweden University, SE-831 25 Östersund, Sweden, 2010, *cf.* p. 8.

is increasing with decreasing snow temperature. From Fig. 3.8, one can notice that the nonlinear dependence of the friction coefficient (μ) on temperature attains its minimum at about –3 to –5C° (27 to 23F°). Thus, provided we use the *cæteris paribus* assumption for all variables except temperature, the most effective sledging snow temperature is bound to this range. As snow temperature decreases, one observes roughly a *ten times* increase the of friction coefficient, which reaches its maximum plateau at about –40C° (–40F°).

It is hard to believe that this dramatic increase of the friction coefficient due to decreasing temperature can escape one's attention. However, apparently it eventually escaped Captain Amundsen's attention (or he had chosen to do so[53]), and was noted by Captain Scott with interesting and insightful notes.

I will comment on the above in the context of Captain Scott's and Captain Amundsen's expeditions in the next subsection of this chapter. To finish the current subsection, I wish one more time to emphasize that friction is a multivariable, complex physical phenomenon, and at given circumstances, a number of parameters may significantly contribute to the value of friction force.[54] Therefore, as one cannot rule out this notion at specific conditions and low temperatures, the friction coefficient may not increase as much as depicted on Fig. 3.8. It would be interesting to study field (real) snow friction and look at it as a self-organized criticality. One can define a friction event as an event equal to certain pre-defined energy loss during the event.

3.1.3. Day and Night Sledging

To my knowledge, it was William Parry (1790–1855) who, at the beginning of the nineteenth century and during his Arctic voyages, described and implemented night travelling in polar regions[55]

> It was my intention to travel wholly at night, and to rest by day, there being, of course, constant daylight in these regions during the summer season. The advantages of this plan, which was occasionally deranged by circumstances, consisted, first, in our avoiding the intense and oppressive glare from the snow during the time of the sun's greatest altitude, so as to prevent, in some degree, the painful inflammation in the eyes called "snow blindness", which is common in all snowy countries. We also thus enjoyed greater warmth during the hours of rest, and had a better chance of drying our clothes; besides which, no small advantage was derived from the snow being harder at night for travelling.

However, Parry's *Farthest North* record of 82.75, that stood for almost fifty years, was achieved in a much milder Arctic climate compared to Antarctica at a similar southern latitude. Therefore, the advantage of Parry's night travelling resulting from 'the snow being harder' may not be applicable to Antarctica conditions. Besides, Parry was travelling in temperatures around freezing, and slush ice was a great hindrance.

Some eighty years later, Commander Scott, Dr Wilson, and Lt Shackleton were struggling across the Ross Ice Barrier. Their goal was 'to get as far south in a straight line on the Barrier ice as we can, reach the Pole if possible, or find some new land'.[56] On Nov. 28th, 1902, Commander Scott remarked[57] "To-night we discussed the pos-

sibility of getting some benefit by marching at night; it was very warm to-day in the sun, and the air temperature was up to + 25° [F, –3.9°C]."

+ 25°F is quite a high temperature, even for Antarctica's summer at the Barrier, and Commander Scott's party was determined to take advantage of it[58]

> On the days which followed we gradually made our starting hour later until we dropped into a regular night marching routine; we then used to breakfast between 4 and 5 p.m., start marching at 6 p.m., and come to camp somewhere about three or four in the morning. Thus while the sun was at its greatest altitude we were taking our rest, and during the chiller night hours we marched … Other drawbacks were that we were often obliged to march with the sun in our faces at midnight, and that sometimes the tent was unpleasantly warm during the hours of sleep.

A similar tactic was assumed by Captain Amundsen on his return trip from the South Pole[59]

> We intended in future to travel at night; the advantages of this were many and great. In the first place, we should have the sun behind us, which meant a good deal to our eyes. Going against the sun on a snow surface like this tells fearfully on the eyes, even if one has good snow-goggles; but with the sun at one's back it is only play. Another great advantage which we did not reap till later was that it gave us the warmest part of the twenty-four hours in the tent, during which time we had an opportunity of drying wet clothes, and so on. This last advantage was, however, a doubtful one, as we shall see in due course.

From the above accounts and arguments, it may seem to one that night travel is indeed a vital method of polar travel. It certainly seemed to Admiral Parry, Captain Amundsen,[60] Captain Scott during the *Discovery Expedition*, and to Roland Huntford, who on this account scoffed at Captain Scott in characteristic fashion[61]

> Now heading north, Amundsen changed to night travel in order to have the sun behind and avoid dazzle from the snow; another detail that evaded Scott.

However, the night travel issue did not evade Captain Scott's attention during the *Terra Nova Expedition*. On the contrary – and assuming that he knowingly took the decision not to travel during the night – Captain Scott's day travel was the only choice possible.

Three issues, accounting for the advantages of night travel, are primarily given by the above mentioned explorers. These issues are:

- Avoiding (minimizing) dazzle,
- Relative warmth during the hours of rest,
- Drying clothes.

Curious readers, however, would be immediately apprehensive about these apparent advantages. It is true that the Captain Scott and Captain Amundsen parties suffered in different degrees from snow blindness. But why did Captain Amundsen not march during the night on his outward journey?

The clothes drying process is primarily driven by a mass transfer process consisting of the removal of water by evaporation. Physically, the preliminary factor which

controls the evaporation rate is the gradient of water concentration on clothes and surrounding atmospheric air. It is every boy scout's experience gained by outdoor clothes drying in rainy and sunny days and/or summer and winter (dry) time, at least in a continental climate. Heat from the sun and wind velocity are additional, but secondary, factors. Provided that Antarctica is the driest continent on Earth, evaporation is the main process responsible for drying clothes. The very low or null humidity of the Antarctic continent (especially its interior) has been well known since the *Discovery Expedition*.[62]

Because avoiding dazzle and drying clothes are doubtful reasons for choosing night travel, one has to consider the question of relative warmth during the day hours rest. In other words, the temperature difference between day and night should be investigated. The respective daily temperature changes are already presented on Figs. 3.4 and 3.5. Fig. 3.5 is especially interesting, as it depicts daily minimum temperature occurrence in a period of the year when both Captain Scott's and Captain Amundsen's expeditions took place. Clearly, as discussed in relation to Fig. 3.5, most minimum temperature occurrences were recorded during the night hours. From this perspective, indeed night travel may be justified as a way of increasing sleep comfort during the day hours.

However, by selecting the night *modus operandi* of polar sledging, one has to be aware that the sliding friction coefficient is also changing with temperature change, as depicted on Fig. 3.8. Thus, one has to look carefully at optimization of sleeping comforts *vs*. energy expenditure due to friction.

The following remark made by Captain Scott on Nov. 22nd, 1911 shows his insight into sledging conditions[63]

> The surface is much easier for the sledges when the sun is warm, and for about three hours before and after midnight the friction noticeably increases.

Comparing Captain Scott's above observation with Fig. 3.5 depicting the occurrence of *daily* (within a 24h period) near surface minimum temperatures at Schwerdtfeger (solid circles), one can notice that the bigger number of these occurrences is positioned during the night hours (NZST). Also, after consulting temperature dependence of the friction coefficient as depicted on Fig. 3.8, one has to conclude that the modern temperature record entirely confirms Captain Scott's assessment.

With this knowledge, it was up to Captain Scott to choose for his party to march during the day hours. Apparently, he preferred day marches with low sledge friction above Captain Amundsen's above mentioned reasons to march during the night hours.

3.2. How Cold Can it Get on the Barrier?

The question in the title of this section is indeed important, yet difficult to answer, especially one hundred years ago. Captain Scott, with regard to the meteorology of the region, could only refer to his own *Discovery Expedition* records, and to Lt Shackleton's weather data from his book, *The Heart of the Antarctic*[64]

> The mystery of the Great Ice Barrier has not been solved, and it would seem that the question of its formation and extent cannot be determined definitely

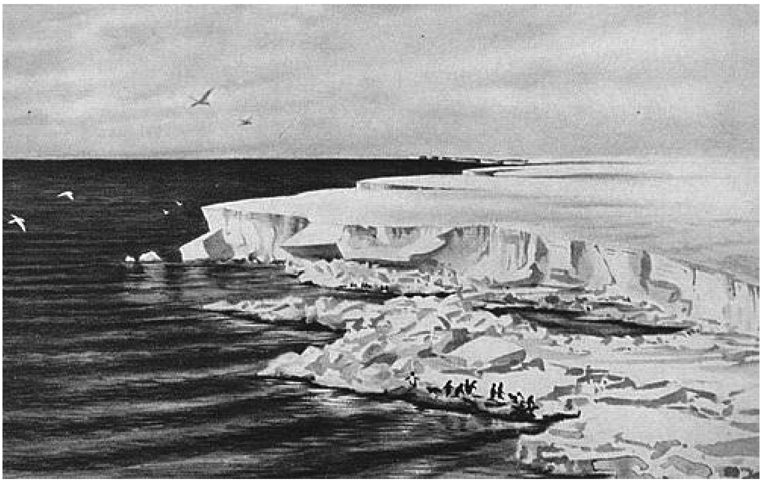


Figure 3.9. The Great Ice Barrier, looking east from Cape Crozier – a water-color drawing by Dr Edward A. Wilson.[1]

[1] Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R.F. Scott, R.N., C.V.O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* facing p. 51.

> until an expedition traces the line of the mountains round its southerly edge. A certain amount of light has been thrown on the construction of the Barrier, in that we were able, from observations and measurements, to conclude provisionally that it is composed mainly of snow. The disappearance [*sic*] of Balloon Bight [Bay of Whales], owing to the breaking away of a section of the Great Ice Barrier, shows that the Barrier still [*sic*] continues its recession.

Even without a thorough examination of these meteorological records, one can be certain that they represent spatiotemporal *weather* data sets, and by no means may be used for climatological analysis. At best, Captain Scott and Dr Simpson could use this data for wild speculations.

Even less meteorological data was available to Captain Amundsen at his landing site at the Bay of Whales (Balloon Bight). Certainly, the meteorological data and general descriptions of Carsten Borchgrevink and Lt Shackleton gave little insight. More useful, but still insufficient for educated conjectures, were the data collected during Captain Amundsen's outward journeys in early 1911 to create supply depôts at 80°, 81° and 82° South on the Barrier.

Thus, Captain Amundsen faced all the risks related to two principal questions:

- When to start the South Pole attempt?
- Which route to choose?

The answers to each question separately, or to both questions simultaneously, was a game of finding the most efficient and safe response. In today's terminology, one would say that Captain Amundsen (as well as Captain Scott) was participating in decision making with insufficient data. In the case of Captain Scott, at least some

preliminary indicators were available – short but still somewhat useful weather data and Lt Shackleton's route. For Captain Amundsen, none of that was on hand. I suppose that he never pondered to cross the Barrier and claim the Beardmore Glacier. Therefore, the route of straight south into the unknown was selected, and depôts placed accordingly.

In the case of selecting the date of the outward journey, Captain Amundsen was certainly driven by an ambiguous knowledge of Captain Scott's motor sledges. Towards the end of winter – early August, Captain Amundsen incorrectly assumed – he was restless and his game of guessing the weather was set in motion to figure out the earliest start possible.

The first sign of possible departure came on "August 24th – the sun appeared above the Barrier again for the first time in four months,"[65] and[66]

> The day for our actual start could not be fixed; we should have to wait until the temperature moderated somewhat. So long as it continued to grovel in the depths, we could not think of setting out. All our things were now ready up on the Barrier, and nothing remained but to harness the dogs and start.

The days went by, and the temperature did not suggest the arrival of spring. Captain Amundsen accounted his general feelings by citing everyday conversation[67]

> "I'd give something to know how far Scott is to-day."
> "Oh, he's not out yet, bless you! It's much too cold for his ponies."
> "Ah, but how do you know they have it as cold as this? I expect it's far warmer where they are, among the mountains; and you can take your oath they're not lying idle. Those boys have shown what they can do."

A few days later, Captain Amundsen made an almost fatal observation and decision for his expedition[68]

> September came, with –43.6°F. That is a temperature that one can always stand [*sic*], but we had better wait and see what it is going to do; perhaps it will only play its old tricks again. Next day, –63.4°F; calm and clear. September 6, –20.2°F. At last the change had come, and we thought it was high time. Next day, –7.6°F. The little slant of wind that came from the east felt quite like a mild spring breeze. Well, at any rate, we now had a good temperature to start in. Every man ready; to-morrow we are off.

On Fig. 3.10, I depicted near surface temperatures recorded at Framheim by Captain Amundsen on the way to the South Pole. This figure illustrates how much Captain Amundsen was eager to start his victorious journey to the South Pole. Out of the three temperature measurements on Sep. 7th, 1911; {–25,6, –10,8, –7,6}°F, he picked –7.6°F, the one which suggested that spring had arrived and permitted the South Pole assault.

A small hump, a temperature glitch that lead Captain Amundsen to launch his team into the unknown. Evidently and blindly, he confused weather with climatic seasonal temperature changes. The next day, temperatures dropped again and spring was gone. The party shortly returned to Framheim, and Captain Amundsen promised one more time that the Polar party was to leave as soon as spring came in earnest.

Captain Amundsen was a quick learner, and after his previous reliance on temporary weather readings had ended badly, he looked at the climate instead. Of course, he

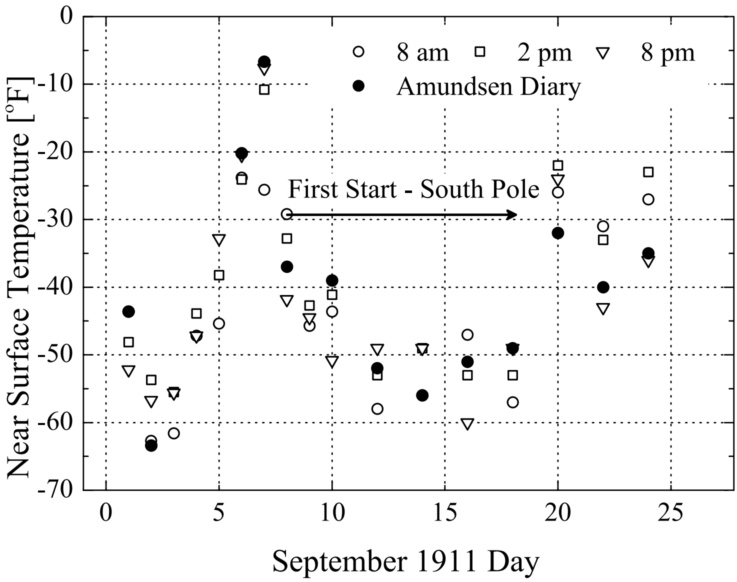


Figure 3.10. Near surface temperatures (°F) for a few days in September 1911, as recorded at Framheim and as given in Captain Amundsen's book/diary. The first South Pole journey attempt is indicated by an arrow starting from Sep. 8th, 1911.

did not have climatological data obtained from many years of observations. Instead, he looked for the appearance of migratory Antarctic animals, and on Sep. 24th, 1911, Bjaaland shot the first seal of the new season. Inevitably for Captain Amundsen and others, it was "a first tidings of spring". "On September 29 a more certain sign of spring appeared with a flight of Antarctic petrels." For the second time, Captain Amundsen was more thoughtful not to equate weather with climate, and departed to the South Pole on Oct. 19th, 1911.

Captain Scott was not looking out for migratory species to set out for the South Pole. The departure time Nov. 1st/3rd, 1911 was predetermined by the well being of his "migratory" ponies, but also by Lt Shackleton's schedule of 1908.

Despite anything said to the contrary, for all heroic age expeditions and for many expeditions long after, the climatology of the Ross Ice Barrier and Antarctic Plateau were not known. That being, the usage of customary terms like expected, averaged, lower, higher, *etc.* Comparison of the weather with climatology was by Lt Shackleton, Captain Scott, and Captain Amundsen entirely unfounded and speculative. Indeed, even now while out on the Barrier or Plateau, there can only be speculation about the weather.

In the previous chapter, I critically examined accounts of the weather during Captain Scott's South Pole journey by several members of the expedition, including Apsley Cherry-Garrard, Charles S. Wright, and T. Griffith Taylor. Their analyses naturally suffered from the authors' assessment of weather and climate, as well as (especially in the case of Cherry-Garrard) from ignorance and inability to learn.

⋮

Inevitably, the analysis of Captain Scott's meteorological record by the chief meteorologist of the expedition and also the Director of the Meteorological Office, Dr George Simpson, after 1919 was analyzed with great interest. However, as I will show, Dr Simpson's account was erroneous, and he participated in a tacit agreement with fellow explorers to play havoc with Captain Scott's weather record.

The first and the most fundamental reservation with Dr Simpson's analysis is that as a trained scientist and meteorologist, he did not address basic concerns relating to the simple fact that he only had weather data in his analyses. Therefore, with all due respect, his analysis was a guessing game of possible weather scenarios. Without addressing this issue in an upfront and a straightforward way, he confused the readers by pairing weather with climate. Under these fundamental circumstances, Dr Simpson's analysis was wild speculation at best without accuracy and sound estimations. I have already shown in subsection 3.1.1 how much different the climatological daily temperature changes at the Barrier are in comparison with Dr Simpson's estimates. Because Dr Simpson used his erroneous mean daily estimations in his calculations of monthly averaged temperatures, one may rightly expect that these estimates would also be flawed. I will show below that this is indeed the case.

The first surprise awaits one when he/she finds that Dr Simpson, in his Meteorology Discussion Volume I, limits his analysis only to the *Extreme Cold Snap*. In his own words[69]

> Captain Scott was well [*sic*] aware of the rapid fall in Barrier temperature during February, but his statement in his wonderful *Message to the Public* that 'no one in the world would have expected the temperatures and surfaces which we encountered at this time of year' was certainly justified [*sic*]. It is difficult [*sic*] to discuss the records of this period mingled as they are with such tragedy, but they clearly bring to light the possibility of great cold at an extremely early period in the year within a comparatively few miles [*sic*] of an open sea where the temperatures were over 40 degrees higher.

I used Latin *sic* (thus as it was written) in the above citation to emphasize Dr Simpson's errors of fact and logic. For example, Captain Scott could not be aware, despite his obvious knowledge of other matters, of how rapid a temperature fall may be expected in February, or during any month for that matter. Dr Simpson's "few miles" is in fact 130 geographical miles – the approximate distance from Cape Evans to One Ton Depôt. What was Dr Simpson trying to make us believe?

After observing the above Dr Simpson formulation, and because of limited data and the fact that "variations in meteorological conditions are generally similar over fairly large areas," it will be more effective to analyze not actual temperatures, but temperature differences between different locations. Thus, by looking at the difference between temperatures at distinct locations, one is looking at temperature "connection" between these sites. Although Dr Simpson did not state it explicitly, he *implicitly* introduced the continuum assumption. This assumption (which indeed reflects the physical properties of the atmosphere) tells us that air properties such as density, pressure, temperature, and velocity, are assumed to vary continuously from one point to another. Moreover, Dr Simpson was aware of prevailing winds over the western part of the Ross Ice Shelf, which drive air masses along the Transantarctic Mountains. See Chapter 1 and Fig. 1.7 for more details.

After analyzing temperature differences between Cape Evans and the Barrier, Dr Simpson looked at a little temperature data collected by sledge parties. This field data he artificially and without justification divided into two regions; south and north of One Ton Depôt. The temperature data south of One Ton Depôt was where the Captain Scott record was collected during the South Pole journey.

From the limited amount of collected measurements during different days of the month at the Barrier and simultaneously at Cape Evans, Dr Simpson calculated the average temperatures and the average temperature difference. His results are depicted in Fig. 3.11.

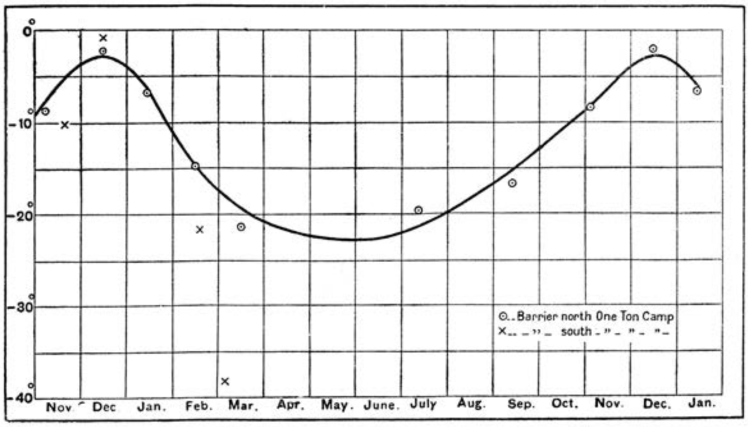


Figure 3.11. Reproduction of Dr Simpson's Fig. 7: Temperature difference between Cape Evans and Barrier.[1] The temperature *difference* is given in °F. ○ and × denotes temperature differences between measurements taken at Cape Evans, and north and south of One Ton Camp (Depôt) during sledging journeys, respectively. The solid line is a smoothed (handmade spline) approximation of data. Attention: the temperature point for the month of October is not shown by Dr Simpson on this figure. The temperature record for Oct. 29th is –7°F. For more, see Tab. 10 in Dr Simpson Vol. I, *cf. p.* 31.

[1] George C. Simpson, *British Antarctic Expedition, 1910–1913, Meteorology*, Vol. I, *Discussion*, Thacker, Spink, and Co, Calcutta, 1919, *cf.* p. 31.

Interpreting the obtained Fig. 3.11, Dr Simpson emphasized[70]

> It will be seen at once that the circles lie fairly regularly about a curve having a maximum in December and a minimum in May or June, and there can be little doubt [*sic*] that this curve gives approximately the mean difference in temperature between Cape Evans and the Barrier north of One Ton Camp throughout the year. By taking the mean values of this curve for each month and applying them to the mean temperature of McMurdo Sound we obtain the mean temperature of the Barrier.

So far, so good. However, Dr Simpson looked at temperature data *south* of One Ton Depôt.[71] That is, the temperature record of the Captain Scott party returning from the South Pole journey

> Turning now to the temperatures on the Barrier south of One Ton Camp [Depôt] we see from the crosses in figure 7 [Fig. 3.11 – KS] that it is impossible [*sic*] to construct a similar curve giving the annual variations of temperature for this region.

But there must be a reason why the crosses – Captain Scott's temperature record – especially the last one at the beginning of March (about –38°F) are out of place. Dr Simpson concluded[72]

> After January, however, the temperature appears to fall much more rapidly over the south than over the north of the Barrier, but for reason already given it is more that probable that 1912 was an abnormal year [*sic*]. It is quite impossible to believe that normally there is a difference of nearly 40 degrees in March between McMurdo Sound and the south of the Barrier. In fact the position of the cross for March in figure 7 [Fig. 2.6 – KS] is further support for the contention that Captain Scott experienced unusually low temperature on his return from the Pole. We are therefore left with the conclusion that the temperatures after the summer are lower over the south than over the north of the Barrier, but that the amount of the normal difference [*sic*] in unknown.

To the observant reader, two questions appear immediately: (1) why did Dr Simpson abandon continuity and introduce the abyss-like division of the Barrier (the Ross Ice Shelf), and (2) what is so special about One Ton Depôt's location?

Initially, One Ton Depôt was planned to be established at 80°S. However, due to Captain Scott's concerns that the ponies would not make it back to Cape Evans, the depot was laid down at –79.483, about 30 miles short of its intended location. The investigative reader could consult section 10.6, titled *The 11 Miles Myth*.

Dr Simpson's *ad hoc* division of the Barrier into regions south and north of One Ton Depôt echoed Captain Scott's Feb. 28th, 1912 conjecture "There is no doubt the middle of the Barrier is a pretty awful locality."[73] However, both Captain Scott and Dr Simpson's conjectures are *questionable cause* logical fallacies – *post hoc ergo propter hoc*. There was, and there is, nothing special or particular about One Ton Depôt's location. Establishing a major depôt at this location resulted *only* from a logistic analysis of Captain Scott's South Pole journey. That is to say, that the decision of establishing One Ton Depôt resulted from reasons unrelated to its location considerations, and long before the actual depôt was established.

One should also notice that while looking into temperature changes north of One Ton Depôt, Dr Simpson assumed continuity of these changes at the Barrier and at Cape Evans.

Thus, without engaging in a more complex analysis, one is certain that Dr Simpson's analysis of the temperature difference between the Barrier and Cape Evans was speculation, and a foolhardy game between weather and climate. By ignoring the already mentioned heuristic constraints, one can ask: is it possible that Dr Simpson was able to guess the correct digits? Modern meteorological records can scour to find the answer to this ill-posed question.

But before comparing Dr Simpson's guessed temperature differences, let us look more carefully at his method. For this purpose, I produced a block scheme of

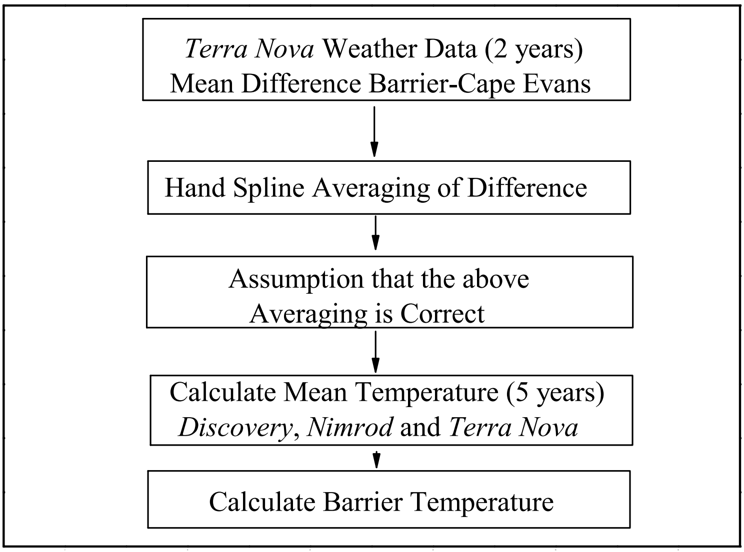


Figure 3.12. Dr Simpson's method of obtaining the mean monthly temperature at One Ton Depôt.

Dr Simpson's method as depicted on Fig. 3.12. In the first step, Dr Simpson used all except Captain Scott's temperature records collected on sledging journeys during late February and March 1912 over the Barrier. Subsequently, the average monthly temperature at the Barrier was calculated, and by comparing this with similar temperatures recorded at Cape Evans, the difference between these two was obtained. The result is depicted in Fig. 3.11. In the next step, a smooth line (in modern terms a spline line) was drawn across the calculated temperature difference, and it was assumed that the obtained line represents a true temperature difference between the Barrier and Cape Evans. Then, Dr Simpson calculated the respective average monthly temperatures recorded during the *Discovery*, *Nimrod*, and *Terra Nova Expeditions* (a combined 5 years' record), and subtracted the obtained temperature values from the averaged temperature over two years' recorded temperature difference, as presented in Fig. 3.11. Thus, Dr Simpson obtained his Tab. 11, titled *Mean Temperature of McMurdo Sound and of the Barrier North of One Ton Camp*.[74]

The title of this table is rather confusing, unfortunate, and exemplifies how Dr Simpson plays havoc with weather data and geographical locations. But before commenting on that, it is useful to look at a comparison of Dr Simpson's described estimates above and modern temperature data recorded at Schwerdtfeger weather station. The result is depicted on Fig. 3.13. The convergence of Dr Simpson's guesses with modern average monthly temperatures differences between Schwerdtfeger and McMurdo stations (1985–2012) is rather poor, but who would expect otherwise?

If one looks at the described details of Dr Simpson's methods (Fig. 3.12), one finds that his evaluation and its result was a pure coincidence.[75] The naïve may think that there is something behind coincidence, or that Dr Simpson's guessing cannot be "mere coincidence". However, for the following reasons, this is wishful thinking.

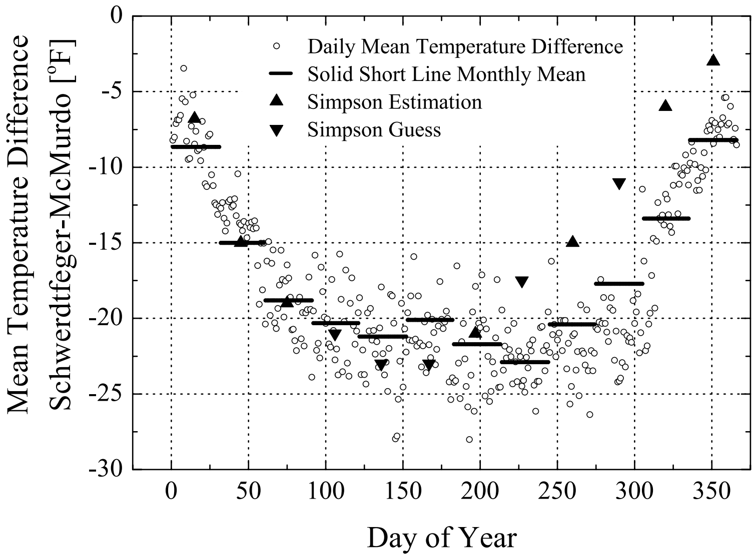


Figure 3.13. Mean (mathematical average) of daily (open circles, ○) and monthly (short solid line) near surface temperature differences between Schwerdtfeger and McMurdo weather stations. Dr Simpson's mean monthly temperatures[1] are indicated by the solid triangles ▲ (calculated) and ▼ (approximated).

[1] George C. Simpson, *British Antarctic Expedition, 1910–1913, Meteorology*, Vol. I, *Discussion*, Thacker, Spink, and Co, Calcutta, 1919, *cf.* p. 32.

Let us assume that Dr Simpson during his analysis of temperature differences between One Ton Depôt and Cape Evans had used undisclosed "meteorological reasoning,"[76] and therefore his result is not a coincidence. If this is the case, then one of the following must be true.

Captain Scott was born on 6 June 1868, and presumably died on 29 March 1912. These two dates give a string of digits {6061868} and {29031912}. If one looks at the decimal expansion of π (Pi) then one finds that the Captain Scott birthday string {6061868} occurs at position 6,011,560, counting from the first digit after the decimal point of π.[77] The naïve may conclude that Captain Scott's birthday occurring at the *exact* position cannot be a simple coincidence and may reveal a hidden (undisclosed) message. However, as its decimal digits have nothing to do with Captain Scott's birthday, the naïve conjecture is unsubstantiated.

By exploring the above avenue, quite possibly like Sir Ranulph Fiennes would do, one can wonder about the meaning of Captain Scott's death date, and look at it as if it was also predetermined by its appearance in the decimal expansion of π. However, the string 29031912 did not occur in the first 200000000 digits of pi after position 0. But then, it may be indicative that the actual death date of Captain Scott was let say the 30th and not 29th March. Indeed, according to decimal expansion of π the string 30031912 occurs at position 81,192,423, counting from the first digit after the decimal point.[78]

⋮

The key, however, is that all the above and below are Dr Simpson's *post factum* analyses. He did not have at his disposal climatological records to work on. More importantly, at the time of planning Captain Scott's journey to the South Pole, only very limited records, as discussed above, were available. Even at the actual planning stage, the climatological data, provided that it was available, was not of much use due to being incredibly short.

However, the intriguing question remains: if Dr Simpson was so able to calculate his temperature estimations at One Ton Depôt, why could he not surmise temperatures reported by Captain Scott a few miles south from the Depôt? In the next section, we will learn that Dr Simpson called the year 1912 an "abnormal year". Despite this statement, he used temperature data to construct expected temperatures in the middle of the Barrier. If data points fitted his picture, he accepted them. In the case of data points which did not fit his weather temperature trends, he simply did not place these points on his figure (see Fig. 3.11 caption) or called them "abnormal," as in the case of Captain Scott's record in late February and March 1912.

In this section, one last question must be asked. Why, only in an accidental location in the south resulting from Captain Scott's expedition logistics, were the temperature data "abnormal"? However, the real question, which was entirely neglected by Dr Simpson, was a question of *variability* of temperature difference between Cape Evans and One Ton Depôt. By looking at this issue, he could find the range of temperature difference fluctuations, and thus find its variability. All he needed to find this was his limited temperature data.

3.3. MCMXII

1912 (MCMXII) was a leap year starting on Monday. On the morning of New Year's Day 1912, seemingly nothing foreboded tragic events. Captain Scott and his party approached the future location of "3 Degree Depôt" located at ~87°S. On the same day, Captain Amundsen and his team reached Devil's Glacier at the edge of the polar plateau, of which the upper (western) part is located at ~87°S. The difference was that Captain Scott was heading south along 170°E and Captain Amundsen's bearing was North along 169°W. The spirits of both expeditions were high, but for different reasons. Captain Scott was pushing hard to be the first at the Pole, and Captain Amundsen was speeding to be first not only at the South Pole, but also at the cable to announce his *Polheim*[79] victory.

In the same year as the publication of the last of the *Meteorology* volumes, Dr Simpson delivered an address at the Halley Lecture in 1923, titled *Scott's Polar Journey and the Weather*. While addressing Captain Scott's temperature records, he wondered about the late February and March 1912 temperatures[80]

> But are these conditions normal? Does the temperature over the south of the Barrier fall to –40°F. Early in March every year as a part of the seasonal variation of temperature? Looking again at Figure 5 [See Ref.[81]], I have already drawn attention to the fact that during these critical weeks the temperature at Cape Evans was abnormally low [*sic*] when compared with observations extending over five years [*sic*], and I have explained this as being the conse-

> quence of an outflow of cold air from the Barrier. The logical conclusion must be that the air over the Barrier was itself abnormally cold [*sic*].

Thus, in addition to the 1912 "abnormal" wind conditions at Cape Evans, Dr Simpson formulated in 1919 and 1923 the next conundrum with locutions like "*abnormal year*", "*abnormally low*" and "*abnormally cold*". Was the year 1912 really an abnormal year? Dr Simpson's locutions and deliberate lies were later diligently rediscovered and repeated by Dr Susan Solomon.[82] But both of them, Dr George Simpson and Dr Susan Solomon, while respectively participating in a tacit agreement with others or themselves, propagated these erroneous notions, and both of them spoke and wrote on the contrary to elementary facts *known to them*. I will examine Dr Susan Solomon's work in Chapter 4. In here, I will stay with Dr Simpson.

The first issue in Dr Simpson's analysis is that he, like Charles Wright, confused weather data with climatological reasoning. The temperature data available to Dr Simpson was simply too small (see Fig. 3.11.) to make reliable analyses, *any analyses*. The points, as depicted on Fig. 3.11 and on Fig. 2.4, are "weather temperature data," not "climate data". Therefore, both Dr Simpson and Wright would have had knowledge of minute temperature data at the Barrier (the Ross Ice Shelf). The solid line drawn by hand across this "weather temperature data" on Fig. 3.11 *is by no means* a climatological curve representing the averaged[83] – over a considerably long period of time – difference between temperatures at Cape Evans and One Ton Depôt. Therefore, no logical reasoning and conclusions can be drawn from Dr Simpson's representations.

While thinking in the above described scientific terms, two questions arise. How many temperature data points are needed to approach a climatological limit, and what do we mean by averaging procedure?

These two questions belong to the *Pantheon* of big, fundamental and still vigorously investigated scientific questions. In Chapter 1, we have a number of times crossed these questions in the form of application of the Central Limit Theorem and ergodic processes.

To illustrate the difficulty of the averaging procedure of a small number of data points, one can wonder about the meaning of average of two data points say {2, 100}. The arithmetic mean (average) is 51, which is a formal result. But if one thinks about physical phenomenona, then the physical interpretation of averaging, and thus the values obtained by averaging procedure, must be given.

The key issue with both Dr Simpson and Wright's analyses is that both of them share an unsubstantiated belief that the outcomes of limited temperature measurements will somehow "even out," and represent values expected from the law of large numbers.

In meteorological terms, it can be described as an unsubstantiated belief that a few weather observations represent climatological values.

An interesting account of the difference between short (weather, see Fig. 3.11) and long (climatology, see Fig. 1.7) term reasoning is given by Dr Simpson's figure depicting prevailing (high) near surface winds over the Ross Ice Shelf. Dr Simpson noticed that "the directions of the sastrugi give valuable information as to the direction of high winds."[84] An example of sastrugi is depicted on Fig. 3.14. Unquestionably, these sastrugi are the result of long term averaging of all wind

Figure 3.14. Sastrugi – "a photograph taken simultaneously [to L. C. Bernacchi's photography in the opposite direction] by E. H. Shackleton (Sh. 172, ¼-plate); looking N. over the same patch of snow-dunes [sastrugi]; the sea-ice of M'Murdo Sound forms the background, beyond the rocky tops of Harbour Heights; Oct. 22, 1902."[1]

[1] *National Antarctic Expedition, 1901–1904: Photographs and Sketches*, Royal Soc., London, 1908, *cf.* p. 181.

directions at a given location. Provided that sastrugi are formed by hard snow, one could say that the wind direction inferred from sastrugi can have a climatological meaning. By the same token, the appearance of migratory animals (provided that one swallow does not make a spring) led Captain Amundsen to correctly read the arrival of spring at the Bay of Whales.

One should also be aware that in many places at the Ross Ice Shelf, the directions of sastrugi are not unequivocal. For example on Nov. 19th, 1911, during the outward journey to the South Pole Captain Scott reported "The sastrugi are confused," and on the next day he accounted "Sastrugi becoming more and more definite from the S. E."

Dr Simpson's above thesis *is not* an explanation of Feb. 27th through Mar. 19th, 1912 – *Extreme Cold Snap* – as it is also erroneously labeled from a factual and logical point of view. Let me first look at Dr Simpson's[85]

> fact that during these critical weeks the temperature at Cape Evans was abnormally low [*sic*] when compared with observations extending over five years.

The data "over five years" to which Dr Simpson is referring constitute temperature measurements by Captain Scott's *Discovery Expedition* (Hut Point), Lt Shackleton's *Nimrod Expedition* (Cape Royds), and of course the *Terra Nova Expedition* (Cape Evans). This data are readily available[86] and anyone, including Dr Simpson, can look into the tables, or better make comparative drawings of temperatures, as I depicted

on Figs. 3.15 (daily), 3.16 (monthly), and 3.17 (yearly) from the above mentioned expeditions' records.

Even a cursory examination of yearly and solely March changes of temperatures depicted on Figs. 3.15, 3.16, and 3.17 shows that temperatures during the year 1912

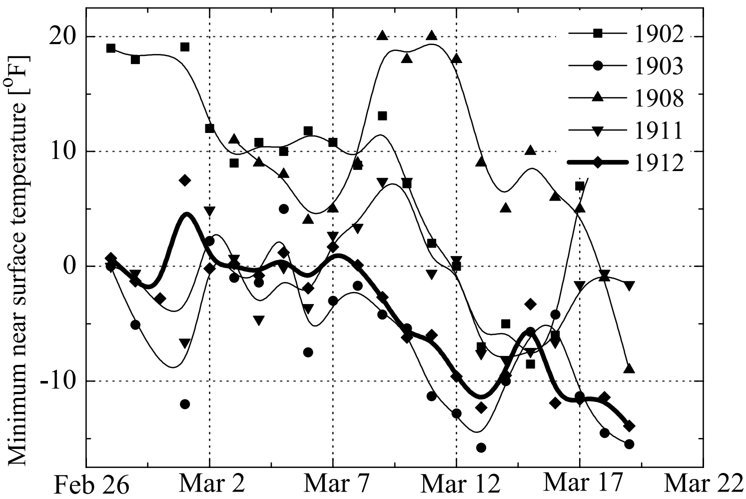


Figure 3.15. Daily minimum near surface minimum temperatures recorded at: Hut Point (*Discovery Expedition*) in 1902 (■), 1903 (●), Cape Royds (*Nimrod Expedition*) in 1908 (▲), and Cape Evans (*Terra Nova Expedition*) in 1911 (▼), 1912 (★), respectively.

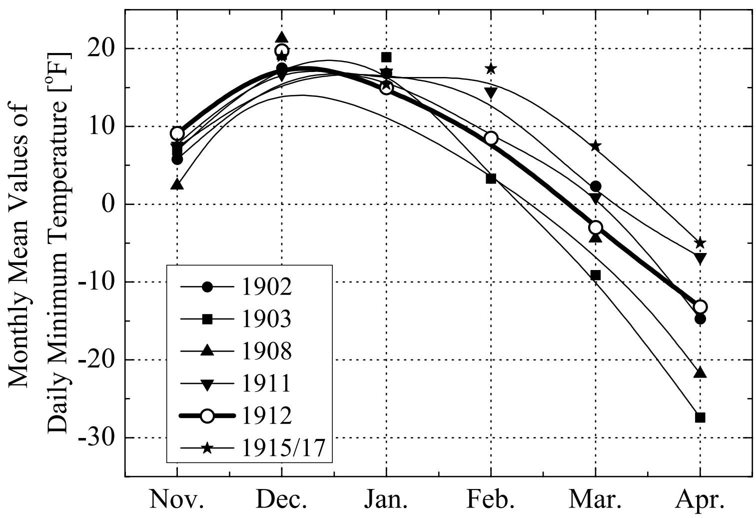


Figure 3.16. A plot of mean monthly temperature data available to Dr Simpson in his analysis of temperature records during Captain Scott's South Pole journey. The data points are associated with years when measurements were taken by respective expeditions, as mentioned in the text. The solid lines (spline fit) between the monthly tick labels are meaningless, but help visual examination of the figure (see also Fig. 3.17 caption).

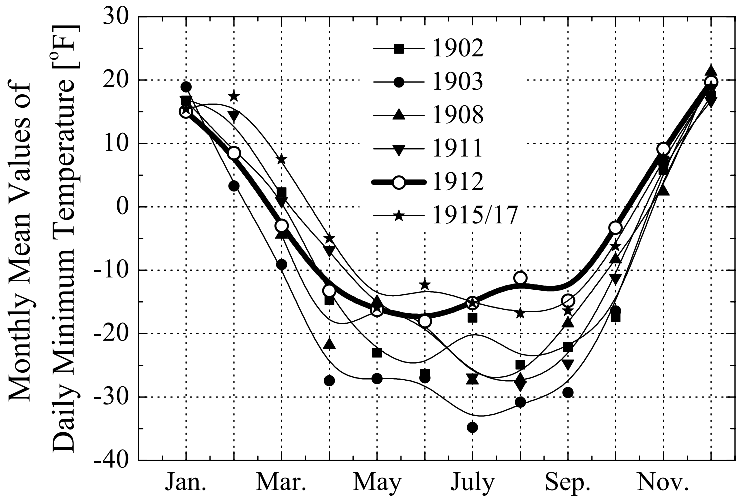


Figure 3.17. A plot of monthly mean values of daily minimum near surface temperatures available to Dr Simpson in his analysis of temperature records during Captain Scott's South Pole journey. The data points are associated with years when measurements were taken by respective expeditions as mentioned in the text. The solid lines (spline fit) between the monthly tick labels are meaningless, but help visual examination of the figure. The data for 1915/17 represent the *Ross Sea Party* data of the *Imperial Trans-Antarctic Expedition* (1914–1917)[1]. One should notice that on this figure all months are equally spaced despite their variable length. This was made for better visual presentation though in reality the Julian day should be used. This miss representation however, does not change observations and conclusions related to this figure.

[1] Fritz Loewe, *The Scientific Observations of the Ross Sea Party of the Imperial Trans-Antarctic Expedition 1914–1917*, Ohio State University, Columbus, 1963.

and/or "critical weeks" in 1912 were in *no way* abnormal, low, or unusual. On the contrary, the temperatures during the whole year 1912 (see also Fig. 3.17) and March 1912 were very much usual, or even above from what one could expect based on analysis of (the heroic age) the expedition's meteorological (weather) data.

Dr Simpson's justification of Captain Scott's *Feb. 27th through Mar. 19th, 1912 – Extreme Cold Snap* data is not only flawed because the cold snap was not observed at Cape Evans. His reasoning is also a logical fallacy, called the *affirmation of the consequent*.[87] This fallacy has been well known since Roman times, and is frequently committed by people and scholars who forcefully try to prove their *raison d'être*. The structure of affirmation of the consequent formal fallacy is as follows: *If $\mathcal{A}$ is true then $\mathcal{B}$ is true. $\mathcal{B}$ is true. Therefore $\mathcal{A}$ is true.*

The structure of the affirmation of the consequent fallacy committed by Dr Simpson is as follows. *If* ($\mathcal{A}$) the air over the Barrier was itself abnormally cold, *then* ($\mathcal{B}$) the temperature at Cape Evans was abnormally low. Compared with observations extending over five years, *$\mathcal{B}$ is true. Therefore $\mathcal{A}$ is true.*

In terms of pragma-dialectic discourse analysis,[88] an argument is good if it avoids committing a logical fallacy. However, as I have shown above, the daily, monthly, and yearly temperature fluctuations at Cape Evans alleged by Dr Simpson to have

occurred in late February and March 1912 did not take place. Therefore, $\mathcal{B}$ is not true and the fallacious reasoning breaks down.

Dr Simpson's arguments regarding the reports by Captain Scott of an extreme cold snap during Feb. 27th through Mar. 19th, 1912 cannot withstand critical scrutiny both from a *factual* and a logical point of view. Above, I have mentioned that Dr Simpson artificially divided the Ross Ice Shelf into two regions, south and north of One Ton Depôt. He suggested that these two regions can be characterized by different meteorological phenomena – in particular with an abrupt fall of near surface temperature south of the depot. Dr Simpson did not explain what was miraculous about the location of One Ton Depôt, and why the continuity of meteorological variables was abruptly braking at this location. Then and now, the continuity notion of meteorological variables continuously fluctuating in a macroscopic world is fundamental in its description.

In Chapter 7, titled *February 27th through March 27th, 1912 – Extreme Cold Snap?*, I will return to analysis of the temperature differences between Ross Island weather stations and temperatures measured at various locations of the Ross Ice Shelf.

3.4. The Never Ending Gale or Blizzard

For now, to finish this chapter, let me look at Dr Simpson's analysis of the second extraordinary meteorological event, *Mar. 21st through 29th, 1912 – Never Ending Gale*. Captain Scott in his *Message to the Public* made reference to 'the storm which has fallen on us within 11 miles of the depot at which we hoped to secure our final supplies'. Reading Captain Scott's journal, one can conclude that the storm which eventually stopped the party and render impossible the reaching of One Ton Depôt lasted for nine/ten days and was a *gale* force storm.

Dr Simpson, in his *Meteorology* Vol. I – *Discussion*, presented a thorough analysis of wind and wind-related phenomena observed in Antarctica during the *Terra Nova Expedition*. A big surprise awaits one: *no* reference to and/or discussion of *Mar. 21st through 29th, 1912 – Never Ending Gale*! It would not be fair if I did not mention a small line where Dr Simpson informs the reader that "The final camp was made on March 21 so that observations were carried on to within ten days of the setting in of the blizzard [*sic*] which proved fatal."[89] However, that is all he had to say about it. Dr Simpson spent more time writing about the origin and usage of the word blizzard[90] than about the fatal Mar. 21st through 29th, 1912 gale. However, the just mentioned short line from Dr Simpson is incorrect. This meteorological event was the *gale*, which lasted nine/ten days, and not a blizzard.

Captain Scott and his journal tell us, "Thursday, March 29. – Since the 21st we have had a continuous gale from W.S.W. and S.W." and continues "Every day we have been ready to start for our depot 11 miles away, but outside the door of the tent it remains a scene of whirling drift."[91]

Caution must be added here so that the reader does not confuse meteorological phenomena like *blizzard* and *gale*. Almost every gale strength wind in Antarctica will create blizzard conditions. The opposite assertion is very rarely true. That is to say, if one like Dr Simpson calls a wind event, described by Captain Scott, a blizzard instead of a gale, then one is intentionally diminishing the severity of a nine/ten days gale,

which inevitably was accompanied with whiteout conditions or "a scene of whirling drift," as Captain Scott commented.

On May 17th, 1923, Dr Simpson presented his Halley Lecture at Oxford University. In its subsequent publication in 1926, Dr Simpson, after a general presentation of meteorological observations in Antarctica, briefly and again incorrectly makes reference to a blizzard, instead of a gale[92]

> Secondly a blizzard [*sic*] of great wind strength accompanied by much snow and drift which continued for ten days at least and probably longer [*sic*].

Dr Simpson's suggestion that the blizzard (*gale*) lasted even more than ten days is laughable. The duration of a blizzard, and Dr Simpson was very well aware of that, can be anything from an hour or two to several days.[93] But ten and probably longer, as Dr Simpson proposes, is of unheard proportions (in terms of released kinetic energy) wind events. Indeed, such a wind event, if it occurred, would be of catastrophic proportions measured by the amount of released energy, not only for Captain Scott's party, but also for the party at Corner Camp and Cape Evans (see Tab. 2.4).

Dr George Simpson analyzed the relationship between blizzard occurrences and the near surface air temperature. After analyzing possible scenarios, he concluded[94]

> The examples given above have had to be restricted in number, and therefore only typical cases have been chosen from the large number available. It goes without saying that the direct relationship between wind and temperature was not always so clearly shown as in the cases illustrated; but the relationship is more or less discernible throughout. The raising of the temperature by all winds in the winter and the dependence of the temperature on the wind direction in the summer are the two outstanding features of the relationship between wind and temperature at Cape Evans.

Equipped with the above analysis, Dr Simpson, during his Halley Lecture, turned to comment about the Never Ending Gale[95]

> The blizzard which proved fatal to the returning travelers set in on the Barrier on the 20th March. It will be noticed from Figure 5 that on this day the temperature at Cape Evans commenced to rise, and in a few days had not only returned to normal but had exceeded it by more than 10°F. Scott does not say whether the temperature rose when this blizzard set in, but we have other evidence that it did (*vide* temperatures measured by Atkinson on the north of the Barrier at the end of March).

We notic that Dr Simpson is renaming the gale as a blizzard. However, these two meteorological phenomena have *no* interchangeable meaning. Dr Simpson, by selecting only one meteorological variable, made an even more unfounded conjecture. He also suggested that the increase of temperature at Captain Scott's last camp is evident from the simultaneous increase of temperature at Camp Evans and temperatures measured by the Second Relief Party (Keohane and Dr Atkinson) at the end of March 1912. While making this suggestion, Dr Simpson entirely neglected that Captain Scott reported gale winds from Mar. 21st through 29th, 1912, and that this gale was not observed by the Second Relief Party, at Hut Point and at Cape Evans.

Dr Simpson's above account of a Never Ending Gale also serves as an example of how selective and purpose driven his analyses were. Using Dr Atkinson's temperature record (see Tab. 2.4), he confirmed his own concept that blizzard events lead to an increase of air temperature. However, he neglected to mention that Dr Atkinson, while fully exposed to all weather fronts of the Barrier, did not record gale winds simultaneously reported by Captain Scott.

Vide supra, I reproduced in Tab. 2.4 the Register of the Second Relief Party. This register, taken from Dr Simpson's *Meteorology, Vol. III: Tables* tell us not only that the temperature rose, but also chiefly that the wind velocity at the Barrier (its northern part) was for several days somewhere about a mild 2 on the Beaufort scale. This Beaufort number is called a *Light Breeze* – wind felt on exposed skin. Leaves rustle and wind vanes begin to move.[96] How a light breeze experienced for several days by the Second Relief Party relates to Captain Scott's gale wind (progress on foot is seriously impeded) remained and remains unanswered. The lack of Dr Simpson's analysis of the Never Ending Gale creates a string of uncomfortable questions. Unfortunately, instead of addressing the just mentioned enormous difference in wind conditions, Dr Simpson ended his lecture appealing to sentiments[97]

> There is little doubt that this blizzard removed the cold stagnant air [*sic*], and the conditions over the Barrier become much better for sledge travelling. But it was too late; by the time the blizzard ceased every man of the Polar Party had passed away, and in doing so had left a record and created a tradition of which every Englishman is, and always will be, proud.

Interestingly, Dr Simpson's appeal to sentiments appeals also to the selective choosing of scientific evidence. Indeed, Dr Simpson devoted the relationship between temperature and wind velocities at Cape Evans a whole section in his *Discussion* volume.[98] He presented the blizzard of Sep. 16th – 17th, 1911 when there was an increase in wind velocity, and a general increase of air temperature was being observed (warm blizzard). He also presented the Feb. 14th – 16th, 1912 blizzard (cold blizzard), when temperature decreased with an increase of wind velocity. Dr Simpson also presented intermediate cases, and concluded[99]

> The examples given above have had to be restricted in number, and therefore only typical cases have been chosen from the large number available. It goes without saying that the direct relationship between wind and temperature was not always so clearly shown as in the cases illustrated; but the relationship is more or less discernible throughout. The raising of the temperature by all winds in the winter and the dependence of the temperature on the wind direction in the summer are the two outstanding features of the relationship between wind and temperature at Cape Evans.

It is evident that Dr Simpson in his own analysis did not arrive at a unified and definitive understanding of the relationship between blizzard and air temperature. Why then, while trying to describe weather conditions during the final march of the Captain Scott party, is he suggesting that the "blizzard removed the cold stagnant air"? On what basis is he assuming a warm blizzard event? One would suggest that after the *Feb. 27th through Mar. 19th, 1912 – Extreme Cold Snap*, that one should not expect the cold blizzard, which would further lower the temperature. Therefore, the

warm blizzard must have followed. But then, if the warm blizzard, the never ending gale Mar. 21st through 29th, 1912, followed the cold snap, why was only an elevated temperature, and not simultaneously a gale force wind, recorded by the Second Relief Party? Why were both weather events of *Feb. 27th through Mar. 19th, 1912 – Extreme Cold Snap* and *Mar. 21st through 29th, 1912 – Never Ending Gale* not recorded at the Cape Evans station?

On Fig. 1.7, I presented Dr Simpson's depiction of near surface airflow around Ross Island and the western parts of the Ross Ice Shelf regions during blizzards or near surface high wind velocity events. His figure indicated that at least in the case of high winds, an unspecified relationship exists between winds on the Barrier and at Ross Island. This unspecified in mathematical terms relation can be described as if high winds blow on the western side of the Barrier, their tails easily flow toward Ross Island, and thus must be recorded at Cape Evans. Thus, the *Never Ending Gale* as reported by Captain Scott must be observed at Cape Evans, and say Corner Camp. Dr Atkinson did not observe it or its tail in late March 1912. More importantly, this piece of evidence should be detected and reasoned by Dr Simpson. On the last figure in the current chapter, Fig. 3.18, I depicted wind velocities recorded at Cape Evans during Mar. 21st through 30th, 1912. The observed wind behavior during late March 1912 must be regarded as ordinary, and only in less than 25% of the depicted time span recorded was the wind velocity equal to gale force. The conclusions are palpable.

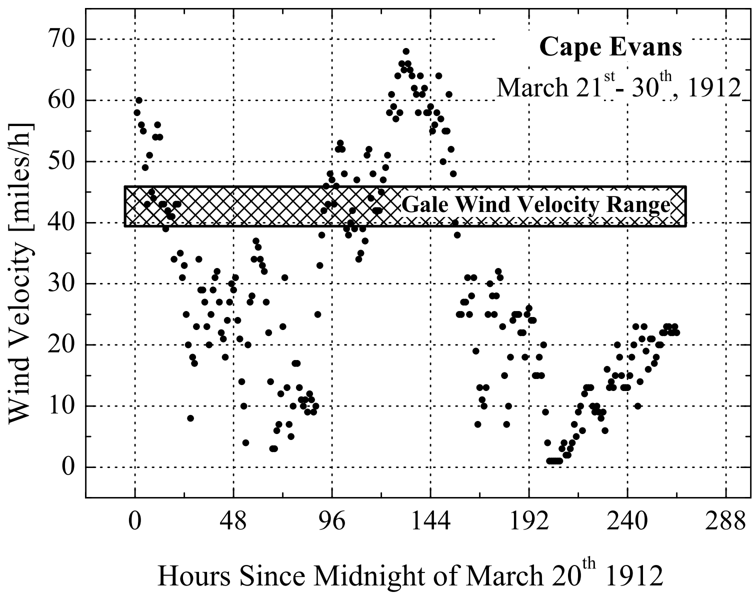


Figure 3.18. Wind velocity recorded at Cape Evans weather station during Mar. 21st through 30th, 1912.[1] The range of gale force wind velocities (39–46 mph) is also indicated on this figure.

[1] George C. Simpson, *British Antarctic Expedition 1910–1913: Meteorology*, Vol. III, *Tables*, Harrison and Sons, Ltd., London, 1923, Table 14.

3.5. Synopsis

Who else, if not a chief meteorologist such as Dr George C. Simpson, could account for the meteorology of Captain Scott's *Terra Nova Expedition*? Unfortunately, this is not the case for his analyses, at least in regards to his analysis of the weather events during Captain Scott's South Pole journey. Dr Simpson was a trained meteorologist. His weather and climate assessments of temperature records during the South Pole journey were fundamentally in error. Thus, Dr Simpson played havoc with meteorological records of the expedition, and introduced cliché conundrums with locutions of 1912 being an *abnormal year*. After being introduced by Dr Simpson, the abnormality of 1912 was picked up and publicized by Cherry-Garrard in his widely read and popular book.[100] However, I have shown that meteorological records of Captain Scott's expeditions, combined with Lt Shackleton's weather data, does not confirm a notion of special weather conditions not only during the whole 1912 year, but also not during the crucial months and even days of February and March of the same year. It must be stressed that this conclusion was evidenced without any hindsight. A simple plot of averaged temperatures of the *Discovery*, *Nimrod*, *Terra Nova Expeditions* and *Imperial Trans-Antarctic Expedition* was sufficient for the conclusion that nothing abnormal was observed in the temperature records of 1912.

Dr Simpson's counterfactual conclusions are indeed astonishing. In all his writings describing Captain Scott's weather records during the South Pole journey, Dr Simpson played havoc with the records and presented false descriptions of weather and climate, and of meteorological phenomena.

It should be also noted that Dr Simpson almost entirely neglected to find an explanation to the nine/ten day gale in late March, which ultimately finished off the Captain Scott party. Why did Dr Simpson ignore this issue? The wind record concerned was in the same time period as the temperature record. For Dr Simpson, on the basis of 1912 being an abnormal year, it was a small step to create a *post hoc ergo propter hoc* fallacy in which one event (the nine/ten day gale) occurred before the *Extreme Cold Snap*, and so may be considered a false account of what actually happened.

The most important conclusions of this chapter are as follows:

1. Dr Simpson's analysis of Captain Scott's meteorological records is tantamount of weather and climate,
2. Dr Simpson's proof that Cape Evans was/is an "abnormal" location particularly exposed to blizzard wind events is not true,
3. The wind behavior at Cape Evans is described by self-organized criticality,
4. Dr Simpson was erroneous in his average daily temperature guesses,
5. Cherry-Garrard was erroneous in saying that the dead weight of sledge does not influence sledging efficiency,
6. Captain Scott's choice of sledging during the day during the South Pole journey was a reasonable decision due to temperature dependence of friction coefficient,
7. Dr Simpson's weather and climate calculations were tantamount in his estimation of the Barrier temperatures being grossly incorrect,

8. 1912 was a meteorologically ordinary year. February and March 1912 were meteorologically ordinary months,
9. Dr Simpson presented a counterfactual lie that 1912 was an "abnormal" year,
10. Lack of analysis of the March 21st through 29th, 1912-Never Ending Gale by Dr Simpson represents his intention to concur with Captain Scott's exaggerations of weather conditions during his South Pole trek.

Chapter 4

Dr Solomon's Fabrication of Meteorological Data, Fallacious Analysis, and Temperature Mania

I know this is a delusion – but when people believe a delusion they believe it harder than a real fact …

William T. Sherman[1]

The history of science, like the history of all human ideas, is a history of irresponsible dreams, of obstinacy, and of error. But science is one of the very few human activities – perhaps the only one – in which errors are systematically criticized and fairly often, in time, corrected. This is why we can say that, in science, we often learn from our mistakes, and why we can speak clearly and sensibly about making progress there.

Karl R. Popper[2]

Research misconduct means fabrication, falsification, or plagiarism in proposing, performing, or reviewing research, or in reporting research results … It does not include honest error or honest differences in interpretation or judgment of data.
[Scientific misconduct is]
(1) fabrication, falsification, plagiarism or other serious deviation from accepted practices in proposing, carrying out, or reporting activities funded by NSF [National Science Foundation] or (2) retaliation of any kind against a person who reported or provided information about suspected or alleged misconduct and who has not act in bad faith.

Code of Federal Regulations (USA)[3]

From the previous chapters, we already learned how various *Terra Nova Expedition* members and authors created a crucible of counterfactuals and/or straightforward lies while exercising a tacit agreement of not addressing issues related to the expedition's meteorological records. It is hard to believe how irrational these actions were. It is equally hard to believe that these dissected counterfactuals shown in the previous chapters resulted from negligence and/or miscomprehension of the meteorological issues. Of course, I did not describe every counterfactual spotted in these writings. It

would be tedious for the reader, and equally uninteresting to me to think and write about it.

In human activity, one can distinguish two types of errors: unintentional and (unfortunately) intentional. The cognitive study of human error is a very active field of research. However in this chapter I will not address unintentional errors. On the contrary, I will present how Dr Susan Solomon not only multiplied Dr Simpson's errors, but also manipulated and dragged Captain Scott's meteorological data to "prove" her case, which is not an easily defined thesis. Dr Solomon's notion was formulated in the psychological terms of her predecessors. If Dr Simpson, Cherry-Garrard and Huxley's manipulations of Captain Scott's meteorological record went undetected and only helped them in their personal/professional lifes, then why not follow a similar path? To repeat their results only by messing with meteorological records would be unattractive and unappealing. However, if the meteorological records were re-analyzed by scientists using the scientific method(s) supported by modern meteorological data, then its scientific merit would have a natural appeal. It has worked, at least until today!

Thus, Dr Solomon's plot of "scientific epiphany"[4] was simple: attribute to Dr Simpson a correct meteorological data analysis of Captain Scott's expedition, and confirm it with modern data and methods.

I have already presented a critical examination of Dr Simpson's analysis of the *Terra Nova Expedition*. My scrutiny of Dr Simpson's work was naturally critical, as required by basic methods of scientific inquiry.[5] However, Dr Solomon chose the opposite. After all, who would want to look critically into Dr Simpson's obscure publication! In writing, she simply praises Dr Simpson's analysis[6]

> Simpson pored over the expedition's meteorological records with care, devoting considerable attention to such key technical matters as instrument design, precision, and calibration.

As for the predictive powers of Dr Simpson's analysis, Dr Solomon entirely forgot about his tantamount of weather and climate[7]

> Simpson estimated the average annual cycle of temperatures to be expected on the Barrier. About seventy years passed before the conditions on the Barrier began to be systematically measured, allowing a test of Simpson's predictions based on this simple analysis. Recent data reveal that Simpson's 1919 [*sic*] estimate was stunning in its accuracy, as shown in figure 37. Scott and his men gathered enough data [*sic*] for Simpson to surmise precisely what average conditions would be like deep in the heart of the Barrier throughout the year.

Dr Solomon' suggestion that "Scott and his men gathered enough [*sic*] data" is indeed "stunning" and foolhardy. It is like saying that someone who has won a lottery by selecting the winning numbers has a key and/or system to pick right numbers out of a random sequence. However, provided that one wants to cheat others, she or he can offer strategies, predictions, mathematical solutions and more to give you the best chance to win. For many, but not for all, common sense and the science of statistics tell us not to follow these crooks.[8]

But another question must be also considered. This question is indeed simple: why was anyone at the beginning of the twentieth century concerned with Antarctica's

weather and climate? In the light of research on global climatology, as I described in Chapter 1, meteorological data from the Antarctic continent were more than welcomed. However, what was the meaning/importance of Antarctica's weather for launching all Antarctic expeditions? Would they go if the climatological temperatures were say 10–20°F lower/higher than presently known? Would they go if they knew the range of the temperature fluctuations? I think that the answer to these questions is affirmative. Of course, they knew nothing or very little about temperatures and their fluctuations. Thus, with such a limited knowledge, Lt Shackleton, Captain Scott, and Captain Amundsen were pushing forward to be first to the South Pole. They gambled on assumptions that the weather of Antarctica and in the areas of their exploration routes would not kill them due to exposure. They risked their own and comrades' lives to be the first at the Pole. These were indeed bold endeavors.

4.1. Proceedings of the National Academy of Sciences

The Proceedings of the National Academy of Sciences of the United States of America, (henceforth PNAS) is the official journal of the United States National Academy of Sciences. This multidisciplinary journal has been published since 1915 and accepts scholarly manuscripts in physical, biological and social sciences.

In the Nov. 9th, 1999 issue of PNAS appeared an article co-authored by Drs Susan Solomon and Charles R. Stearns. The title of the paper was *On the Role of the Weather in the Deaths of R. F. Scott and his Companions*.[9] Its PDF version is readily available.[10] The article contained five pages and four figures, and was edited by James E. Hansen,[11] who not only heads the NASA Goddard Institute for Space Studies but also is a climate-change activist. At the time of publication and at first glance, it seemed to be an interesting and more importantly scholarly (see my Prolegomenon in this book) research contribution to the analysis of Captain Scott's expedition. However, even after a cursory read, one can easily spot the some problems as in Dr Simpson's writings: weather and climate tantamount, and fallacious reasoning. Drs Solomon and Stearns, instead of a critical and constructive examination of previous works, fell into thoughtless praise of Dr Simpson's meteorological analysis. However, I demonstrated in Chapter 3 that although Dr Simpson's meteorology summary of the *Terra Nova Expedition* is important for its field data collection and significant contribution to general meteorology of the Antarctic continent (see Chapter 1), it terribly suffers from a number of inexcusable scholarly drawbacks, especially concerning analysis of the *Extreme Cold Snap* and *Never Ending Gale*.

In the next two subsections, I will attempt to present a critical analysis of Drs Solomon and Stearns' counterfactuals presented in the PNAS article. My task is indeed not easy. The difficulty arises from the specious writing of these authors, where in one or a couple of the following sentences the fusion (confusion) of weather and climate is present. I therefore ask the readers for patience.

Before proceeding with the analysis of the main issues of this work, let me briefly comment on some inaccuracies selected out of many, which together make Drs Solomon and Stearns' article unacceptable as a scholarly work.

All distances given in their work are grossly exaggerated, and all coordinates of geographical locations are incorrect. For example

> Scott and two remaining companions ended their terrible trek of more than 1,600 miles [*sic*] near the end of March, 1912, in a tent at roughly 79.6°S, [*sic*] 170°E, about 170 miles [*sic*] from the safety of their base.

The authors do not inform the reader which miles (nautical/geographical miles or statute miles) they use in the manuscript. For example, they estimate the total number of miles traveled by Captain Scott party to be "1,600 miles". The actual distance traveled was about 1,369 geographical miles (2 × 749–118–11 or 22) – two times the distance to the Pole minus the distance from One Ton Depôt, and minus the claimed or actual distance from the depot to the last camp (for more see section 10.6). See Fig. 2.3 for more details. Drs Solomon and Stearns did not state what miles they were using. However, if they used statute miles, then the distance covered is 1,575 miles and not 1,600 miles. Similar inaccuracies occur also in the distance to the South Pole and distance from Cape Evans to One Ton Depôt (130 miles) and the tent (130 + 11 or 22) miles), and not 170 as given by Drs Solomon and Stearns. The location of the tent (the last camp) at 79.6°S (79°36′S) is also incorrect. For more on that, see section 10.6.

In the abstract of Drs Solomon and Stearns' paper, in order to justify their work they formulated an entirely nonsensical observation

> Numerous contributing causes for their deaths have been proposed, but it has been assumed [*sic*] that the cold temperatures they reported encountering on the Ross Ice Shelf, near 82–80°S during their northward trek toward safety, were not unusual [*sic*].

Indeed, only Drs Solomon and Stearns knew everyone was assuming that Captain Scott's reported temperatures in late February and March 1912 were usual ("not unusual"), and only they pretend that Captain Scott's *Message to the Public* was never written. In it, Captain Scott was *explicit* about the weather near 82–80°S, where he said "no one in the world would have expected the temperatures and surfaces which we encountered at this time of the year."

In order to confuse the reader, just a few lines later, in what may be understood as an introduction to their paper, the authors explain that

> The meteorologist of Scott's expedition was George C. Simpson, who left Antarctica before Scott's body was found [*sic*]. In 1919 [*sic*], Simpson published a three-volume treatise reporting his pioneering studies of polar meteorology; in that work he concluded that "Captain Scott experienced unusually low [*sic*] temperatures on his return from the p[P]ole" (ref. 4, p. 32). Simpson is quoted by another surviving member of the expedition as stating that the polar party would have survived in 9 of 10 years, but struck the 10th unlucky one (ref. 2, p. 594).

In Chapter 3, I already examined Dr Simpson's work and his analysis of the meteorological records of Captain Scott's party. However, Drs Solomon and Stearns' probabilistic locution that the party was struck by the 10th unlucky streak is an example of the author's wild manipulation of the data. Attributing this locution to Dr Simpson is also incorrect. It was Cherry-Garrard who, with his dose of discretion, concluded that[12]

> Nine times out of ten, says the meteorologist, he would have come through: but he struck the tenth.

Since Cherry-Garrard could not follow the compass needle or a line of markers (cairns), it would be futile to ask how he calculated this probabilistic argument. But since Drs Solomon and Stearns hold PhD degrees, one could anticipate a scientific justification or critique of Cherry-Garrard's probabilistic argument. No argument is provided, and the authors are comfortable with the Gambler's Fallacy in its extreme form, as presented by Cherry-Garrard. At the time when Cherry-Garrard was writing his memoir, the Barrier had been crossed in late February and March only *once*, as described by Captain Scott's party. How Cherry-Garrard arrived at his probability conjecture of "nine times out of ten" is puzzling. We know already not to trust Cherry-Garrard's analytical skills. But to support scholarly manuscripts with elementary erroneous locution is a foolhardy move on the authors' side. In the next subsection, I will show that the Gambler's Fallacy is the main topic of Drs Solomon and Stearns' research on Captain Scott's meteorological record. In here, let me just remark that the Gambler's Fallacy is a false belief of the presence of a statistical dependence between statistically independent events. Two or more events are statistically dependent if and only if occurrence of one event has statistical influence on occurrence of the other event. When applied to meteorology, it translates to the false belief that if one finds a similar weather event in modern record to an event took place in the past some over seventy years ago, then that past event happened.

To finish this section, I just wish to show how mindlessly both authors formulate unsupported conjectures. For example, using the following lines, they use Dr Werner Schwerdtfeger's work

> A blizzard that struck the team near 83°S while en route to the pole in December, 1911, also added to the expedition's difficulties by laying down a deep layer of soft snow that impeded their progress (7 [reference number to W. Schwerdtfeger's work]).

which indeed echoes Captain Scott's *Message to the Public* entry. Looking more closely at Dr Schwerdtfeger's account, one can find[13]

> For Scott's march to the Pole, the snowstorm at the foot of the Beardmore glacier was a catastrophic [*sic*] event. It meant the loss of four full summer days with all possible consequences regarding the tightly rationed supplies to be carried south. Furthermore, during the first days after the snowstorm when the party had still to reach the foot of the glacier and begin the ascent to the high plateau, the surface conditions could not be worse; it required superhuman efforts to move ahead, not more than a few [*sic*] miles per day. One can only sense awe, or feel compassion, when reading the individual reports. It is a fair guess [*sic*] that without the loss of these days, i.e., without intervention of this extraordinary weather phenomenon, Scott and his men would have made it [*sic*] home.

Remembering that Dr Schwerdtfeger was a meteorologist, it is difficult to understand what he meant by his writing. As mentioned by Dr Schwerdtfeger, is the snowstorm event impossible? Could Captain Scott expect occurrences of different weather

scenarios? And why was the four days blizzard at the foot of Beardmore Glacier "extraordinary"? Should Captain Scott, according to Dr Schwerdtfeger, expect and actually encounter weather conditions supporting his sledging effort? Equally intriguing is also why Drs Solomon and Stearns used Dr Schwerdtfeger's comments to support their work. For distances traveled after the blizzard, see Fig. 4.11, which does not confirm Dr Schwerdtfeger's "fair guess" that the party velocity was "a few miles per day".

Toward the end of the introduction section of their PNAS paper, Drs Solomon and Stearns state

> Remarkably, Scott's and Simpson's statements regarding the temperatures in March of 1912 have been largely ignored [*sic*]. A few authors explicitly dismissed suggestions of severe weather (8), perhaps because such conditions were assumed to be typical for the harsh climate of Antarctica.

To suggest that literally many thousands of readers "ignored" Captain Scott's journal, and especially his "statements regarding the temperatures in March of 1912" in the *Message to the Public* is nonsense and insults the readers. The investigative reader at this moment may also consult Chapter 2 to find who and why "explicitly dismissed suggestions of severe weather".

4.1.1. Temperature – The Cold March of 1912

Most of Drs Solomon and Stearns' article is devoted to temperature records of Captain Scott, and only towards the end is a small paragraph dedicated to wind analysis. Right from the start of reviewing temperature accuracy measurements, the authors produced inexcusable errors[14]

> Only one group continued to the South Pole, carrying one of these three instruments. Scott and his team were within 1° of latitude of the geographic South Pole from January 13 to 23, 1912. The average of the daily minimum temperatures recorded by them during these dates is –23°F [–25.4°F], considering only the ventilated measurements, and –24.1°F [–22.9°F], when the available under-sledge data are also included in the mean (11). The intense solar illumination at the South Pole in summer renders the temperatures relatively consistent there from year to year in this period. The average of the daily minima for January 13–23, recorded annually by the automated weather station at the Pole since 1986, is –22.6°F [–21.65°F], with a SD of 3.7°F, which is in good quantitative agreement with Scott's 1912 data and thus further supports the measurement accuracy.

While looking at the above expound, one additionally has to notice its real intention – to beckon the authors' upcoming fallacious reasoning and tantamount of climate and the weather. It is evident that the authors are trying to find Captain Scott's thermometers' "measurement accuracy". Not an easy *post factum* task. But with a little data falsification and subsequent manipulation, everything can be proven. This is what Drs Solomon and Stearns aimed for, by using the customary appeal of elementary statistics and falsely assuming that daily minimum temperatures at the South Pole are independent and identically distributed (i.i.d.). In reality, the limit distribution of

daily minimum temperatures is drawn from all daily temperatures, with the assumption that these daily temperatures are independent and identically distributed random variables. Therefore, Drs Solomon and Stearns should provide evidence that the daily (for each day for each year) temperatures are independent and identically distributed random variables. Secondly, they should provide evidence that these temperatures are normally distributed. And thirdly, they should prove that selected minimum daily temperatures from these sets of temperatures follow normal (Gaussian) distribution, and thus the correlation coefficient calculation is a mathematically sound procedure. Of course, the authors did not provide evidence for the above. It was shown that the distribution of daily temperatures at McMurdo station, Scott Base, Schwerdtfeger AWS, and Amundsen-Scott station are substantially deviating from Gaussian distribution.[15] Knowing that, however, let us assume, like Drs Solomon and Stearns assumed, that the minimum daily near surface temperatures at the South Pole are normally distributed (Gaussian). In such a case (any distribution with finite first two moments), one can calculate standard deviation as a measure of how the data points are close to the mean (expected value), and also the variability of measured variable. For a normal distribution (Gaussian distribution), the probability that a random measurement falls within n (= 1, 2, 3 …) standard deviations $n\sigma$ of the mean μ is given by a simple formula $P(\mu - n\sigma < x < \mu + n\sigma) = \mathrm{erf}(n/\sqrt{2})$, where $\mathrm{erf}(z)$ is an error function associated with normal distribution and $\mathrm{erf}(z)=\frac{2}{\sqrt{\pi}}\int_0^z \exp(-x^2)\,dx$. Thus, about 68% of data points are within confidence interval equal ±one standard deviation. For ±two standard deviations, about 95% data points are within this confidence interval.

Now let us look at the results of Drs Solomon and Stearns. According to them, the minimum daily near-surface temperature at the South Pole for the period Jan. 13th through 23rd and since 1986 until 1999(or 1998?) is (–22.6 ±3.7)°F. It means that 68% of daily minimum temperatures are in a confidence interval of (–18.9 to –26.3)°F. Consequently, the authors concluded that "is in good quantitative agreement with Scott's 1912 data and thus further supports the measurement accuracy".

However, all the above allegedly scientific reasoning represents data fabrication, data dragging, and scientific misconduct. Let me iterate pertinent issues:

1. All temperature averages given by Drs Solomon and Stearns are incorrect, *i.e.*
   1.1. The daily averaged minimum temperatures recorded by Captain Scott for Jan. 13th through 23rd, 1912 was –25.4°F, and not –23°F,
   1.2. The ventilated measurements average was –22.9°F, and not –24.1°F,
2. The daily minimum average temperature at the South Pole during Jan. 13th through 23rd was –21.7°F, and not –22.6°F,
3. Pointless mixing of Captain Scott's daily temperatures (30 data points) and daily minimum temperatures (9 data points), and comparing it with daily temperatures,
4. Meaningless comparing of temperature records at different geographical locations without first proving that these records are comparable,
5. Comparing non-climatological averages – part of the modern South Pole record 1986–1999, instead of the complete record (1957–1999) – with Captain Scott's weather data.

The investigative reader may easily check the above by consulting Dr Simpson's volume, whose PDF is readily available,[16] and its *Table 72: Register of the Main Polar Party, Cape Evans to Pole and Back to 80°S*, pages 633–635 for the Jan. 13th through 23rd temperature data. While checking the data, the investigative reader must be aware that Drs Solomon and Stearns' ventilated measurements are listed separately in Dr Simpson's Table 72 as "Dry Bulb Temp." and "Minimum Temperature," but were calculated as one by Drs Solomon and Stearns to get their "ventilated measurements".

A summary of Drs Solomon and Stearns' pointless arguments is depicted on Fig. 4.1, where actual near surface daily minimum temperatures recorded at the South Pole (Amundsen-Scott station) for the entire available record (1957–2014) from Jan. 13th through 23rd is presented. If Drs Solomon and Stearns were interested in doing their job honestly, they would get the daily minimum temperature for the entire period from 1957 until 1999; exactly as I indicated on this figure. This result may be considered as a climatology approximation (42 years). Unfortunately, they selected an insufficient 13 years of data, and based on this they advanced their false reasoning.

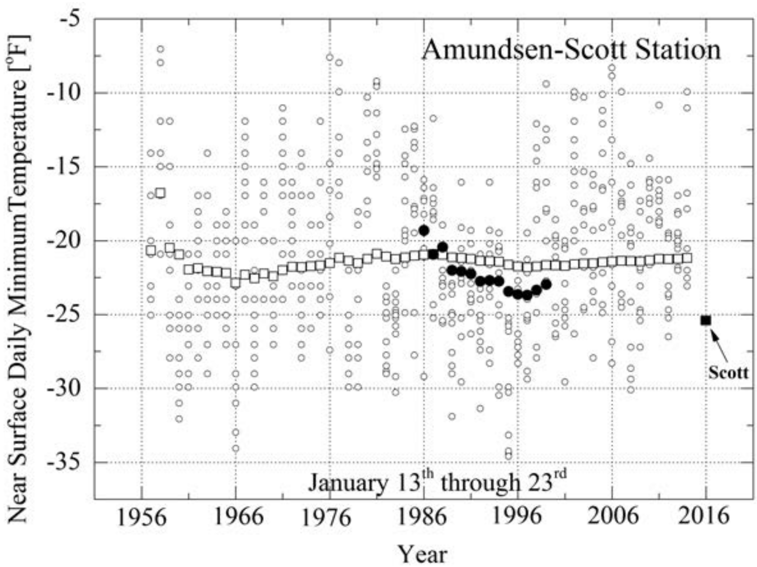


Figure 4.1. Near surface daily minimum temperatures recorded at the Amundsen-Scott station (○) for the time interval Jan. 13th through 23rd and from 1957 until 2014. The moving average of these temperatures is indicated by □. The respective Drs Solomon and Stearns data are depicted by ●. Averaged daily minimum temperature recorded in Jan. 13th through 23rd, 1912 by Captain Scott's party is symbolically indicated by ■ on the right-hand side of the figure. Obviously it is a record for 1912 and not 1912 through 2014. This figure was made only for comparison purpose with Drs Solomon and Stearns' respective figure and analysis.

Consequently, the Antarctic Plateau average minimum daily temperatures given by Drs Solomon and Stearns, as depicted on Fig. 4.2, are incorrect. In addition, on Fig. 4.2 they forged the daily minimum temperatures after day 70. No daily minimum temperatures could have been recorded after day 70/Mar. 10th, 1912, since Lt Bowers broke the

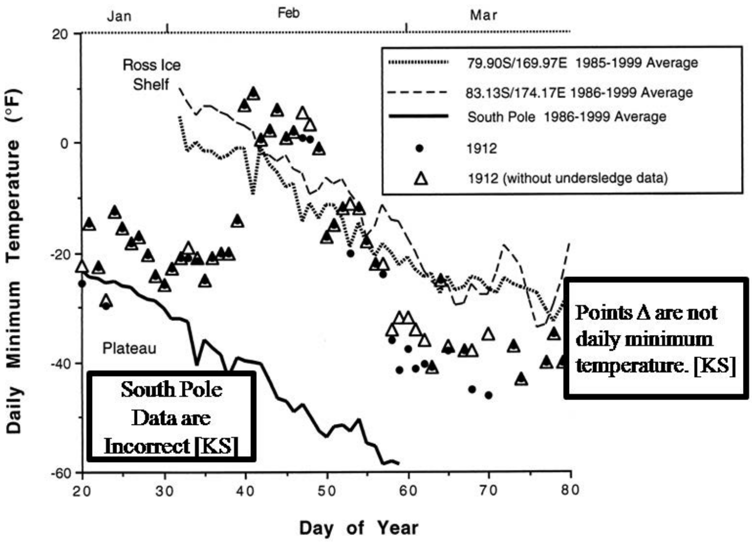


Figure 4.2. Reproduction of Drs Solomon and Stearns' figure "Observations of daily minimum south polar temperatures. Open triangles show the 1912 ventilated data only, whereas filled circles display minima considering available under-sledge daily measurements (11), beginning near the South Pole on January 20 (day number 20), descending to the Ross Ice Shelf near February 1–14 (days 32–45), and continuing until March 19. The rapid warming between days 40 and 45 is caused by the descent from the high plateau at about 10,000 feet elevation to near sea level. The heavy black line shows the average daily minimum at the South Pole (station 5) from automated weather station data, while the two broken lines show the observations from stations at 79.9°S and 83.13°S (stations 3 and 4 in Fig. 1)."[1] Reproduced with permission. © (1999) National Academy of Sciences, U.S.A.

[1] PNAS, *cf.* p. 13014.

minimum thermometer on this day. For the correct values of averaged minimum daily near surface temperatures, the investigative reader may consult Fig. 4.17.

Returning to the main concern of Captain Scott's air temperature record analysis, let me quote a rather long citation from Drs Solomon and Stearns' paper

> The precise daily averaged temperatures experienced by Scott and his men are uncertain because three observations, at most, were made each day (ref. 4, *cf.* p. 17–20). Rather than attempting to construct an average from these sparse measurements, in this paper we examine the daily minimum temperatures that can be derived from the data obtained by Scott and his companions in 1912, and compare these with modern observations. At night, the sling thermometer was sometimes placed under one of the wooden sledges [*sic*] (a type of sled that carried supplies) to shield it from the sun and to estimate the nightly minimum temperature. Although such observations may be biased low by up to 2° [F] because of the pooling of cold air (ref. 4, p. 19), the ventilated data taken while swinging the thermometer only a few times per day are likely to be warmer than the actual daily minimum. It is therefore probable that the true 1912 minima

> lie between the ventilated and under-sledge data; both will be shown here where available.

There are a number of sensitive issues which were incorrectly investigated and reasoned by Drs Solomon and Stearns. In particular, while having at their disposal modern temperature data from the Schwerdtfeger weather station, they did not check the time of daily minimum temperature occurrence. If they did check it, as any elementary act of scientific scrutiny requires, they would make a figure similar to my Fig. 3.5. The conclusion from this figure is palpable. The minimum near surface temperature occurrence is not exclusively restricted to *night hours*, but also occasionally one can record the minimum temperature during the daytime.

I have to acknowledge here that the question of the time of minimum temperature occurrence bothered me very much, and should not be taken so carelessly like Drs Solomon and Stearns did. The daily minimum temperature is a unique signature of daily temperature fluctuations. In the modern temperature measurement setup, the actual temperature at Schwerdtfeger weather station is measured every 10 minutes, and out of these records the lowest daily temperature is selected. During Captain Scott's journey, the party carried a so-called spirit minimum temperature thermometer. I spent a good deal of time figuring out during what hours the measurement of daily minimum temperature during the South Pole journey was taken. Despite this, an important uncertainty remains. Captain Scott's diary indirectly supports what was written by Dr Simpson[17]

> Nearly all the sledging thermometers (spirit) were provided with minimum indices, and after the sledge had been straightened for the night the open thermometer was carefully placed under the sledge in such a position that it was shielded from radiation.

Dr Simpson's description suggests that the minimum daily temperature reported by the Captain Scott party was collected during the nighttime, which is between about 9 p.m. and 6 a.m., NZST (<u>N</u>ew <u>Z</u>ealand <u>S</u>tandard <u>T</u>ime, see section 6.4). It is clear, if compared with modern records of daily minimum temperature occurrences, that Captain Scott's minimum temperatures may not be a true daily minimum. Thus, it may be called the lowest recorded daily temperature, provided that the temperatures recorded during the day, sledging hours, were not lower than the former one.

Analyzing Tab. 72, *The Register of the Main Polar Party, Cape Evans to Pole, and Back to 80°S* from Dr Simpson Vol. III, one can summarize that only occasionally like on Feb. 14th, 1912 the recorded minimum temperature (+5.5°F) was higher than one of the temperatures recorded during a day (+0.8°F, 9:30 p.m.). In the remaining cases, and most importantly for our analysis of temperatures in late February and March 1912 with the exception[18] of Mar. 4th, the daily minimum temperature was recorded by a minimum temperature thermometer during the night. This confirms a general trend of daily minimum temperature occurrences at Schwerdtfeger weather station, as depicted in Fig. 3.5.

Therefore, Drs Solomon and Stearns' mysterious scientific differentiation of Captain Scott's temperature data as data "with" and "without undersledge [*sic*]" is unjustified and unnecessary, as well as their figures, Fig. 3[19] and Fig. 61[20] published by Dr Solomon in her subsequent book.

Additionally, since the dry bulb thermometer was broken by Lt Bowers on Mar. 10th, 1912[21], the remaining record of temperatures is reported according to Captain Scott's personal thermometer. However, what happened with the minimum temperature thermometer of the party is unclear to me from the sparse information provided by the members of the expedition. I will add any discussion related to this question in Chapter 6.

In order to explain Dr Simpson's remark[22] that "there is little doubt that a thermometer so placed [under the sledge] gave minimum temperatures too low by a degree or two" Drs Solomon and Stearns introduced the enigmatic and obscure notion of "pooling of cold air". The phenomenon of pooling of cold air is well known in boundary layer meteorology.[23] However, the lapse rates are about 1°F (100 m)$^{-1}$. Thus, Drs Solomon and Stearns' alleged 2°F cooling on a scale one hundred times smaller (1 m)$^{-1}$ is simply impossible.

Moreover, if Drs Solomon and Stearns were more careful, they would observe that 2°F cooling, as alleged by them, is also in contradiction to the results depicted on Fig. 4.2. For example, on the seventieth day of the year (1912 was a leap year), that is Mar. 10th, 1912, the difference between "ventilated" (●) temperature data and under-sledge (△) is more than 10°F – five times more than mistakenly proposed.

Supported by their figure as depicted on Fig. 4.2, Drs Solomon and Stearns were ready to draw conclusions by comparing averages "obtained over many years since the mid-1980s" with weather (temporary) minimum temperature measurements by Captain Scott's party. However, the serious question arises concerning their implicit assumption. How can one meaningfully compare these averages with the weather (minute) that is Captain Scott's temperature data? And equally importantly, what is the *physical interpretation* of calculating an average of minimum temperatures?

First of all, Drs Solomon and Stearns, by saying that the average minimum temperatures were "obtained over many years since the mid-1980s" falsely imply that temperature records used by them constitute a semi-full or full climatological set. However, this is not the case!

The weather record used by these authors comes from the stations named Elaine and Schwerdtfeger, which became operational in 1986 and 1985, respectively. Unfortunately, Elaine station was also inoperative from October 1988 until 1993, and the temperature data from 1992 and 1995 for Schwerdtfeger are partially corrupted.[24] Thus, the temperature records (10 and 13 years) available to them did not represent a "many years" record without caveats, as the authors insinuate, and certainly did not represent a climatological approximation[25] for a sound reference base.

Secondly, Drs Solomon and Stearns entirely neglected to address the question of the physical meaning of calculating the mean (average) of minimum near surface temperature. From a mathematical point of view, for each day, they calculated a simple mathematical average. However, physical processes in boundary layers are not mathematical events, and are governed by laws of nature. Therefore, if something can be calculated from mathematical equations, for example, a mathematical average, it always must be interpreted within the laws of physics. No equation nor any equation solution exists in physics without its interpretation(s).

As atmospheric sciences are a branch of physics (applied physics), I presume that the same methodology is used in climatology and the weather related research. Therefore, the researcher working in atmospheric sciences cannot simply divide

a bunch of numbers without providing meaning and interpretation of the procedure and its results.

By looking at their figure (Fig. 4.2), the authors commented that it[26]

> … reveals that the minimum daily temperatures experienced by Scott and his men from about February 10 through 25, 1912, while on the southern end of the Ross Ice Shelf were comparable to the climatological average.

We know already from Fig. 4.1 that Drs Solomon and Stearns' temperature averages depicted in Fig. 4.2 *are not* climatological ones. Additionally, and what the reader may be aware of by looking at this figure, Captain Scott's temperature record "from about February 10th through 25th, 1912" is located above Drs Solomon and Stearns' "climatological average". How, then, can both records be "comparable"? What mathematical measure was used to arrive at this statement? The authors do not provide any reason, and one has to assume that their scientific judgment is inaccurate.

Drs Solomon and Stearns in the above comment imply that recorded data of minimum temperatures by Captain Scott's team should (must) be "comparable to the climatological average". The entire premise of their thinking is that the temperature record *must* be comparable to the climatological average. However, why the climatological average temperature must be close to such a short temperature record is not explained by Drs Solomon and Stearns. Of course, there is no explanation to this erroneous thesis. It was shown in Fig. 3.4B that the variability of minimum temperatures at the Schwerdtfeger weather station ranges between ⟨+17.8, –68.8⟩°F for the period Feb. 27th through Mar. 19th, 1985–2009.

By looking at the period which followed that mentioned above, and comparing the climatological average behavior of minimum temperatures, the authors by repeating the above errors formulate their main counterfactual result[27]

> With one exception (March 4, 1912), every day of available measurement from February 27 [*sic*] through March 19, 1912, was characterized by daily minimum temperatures below –30°F, as much as 20°F colder than the long-term [*sic*] average daily minima for this region based on automated weather station data for 14 and 15 years [*sic*] (respectively) at two nearby sites as shown.

The average minimum temperature is not "the long-term": instead of Drs Solomon and Stearns' "14 and 15 years," it is only 10 and 13 years, respectively. To magnify their argument, Drs Solomon and Stearns dragged their previously used initial date of calculating average temperature from Feb. 25th to Feb. 27th.

Certainly, the main result of their work as cited above would not have gained popular appeal, and somehow the abbreviated form was presented[28]

> Only 1 of the 15 [*sic*] years of modern data (1988) displays a nearly [*sic*] uninterrupted period of cold daily minima, similar [*sic*] to 1912.

The above deduction is counterfactual, erroneous, and fallacious. A good number of reasons supporting the scientifically unacceptable methods of these authors were presented above. In the following pages, I will extend the discussion and present additional critical points which disqualify Drs Solomon and Stearns' work.

The investigative reader may wonder why anyone is trying to prove, or better to say, confirm Captain Scott's meteorological record. Is there, in the record, something

that needs to be substantiated? Just by examining the *Terra Nova Expedition*'s meteorological record, one can select a good number of weather events worth studying. Even by restricting the time frame to Captain Scott's journey to the South Pole and selecting the most extraordinary weather event, one would study the never ending gale in late March 1912 instead of the cold snap in February and March of the same year. With no clear answer, I will examine both.

Based on Fig. 4.2, Drs Solomon and Stearns in order to further support their "only 1 in 15 years" fallacious locution produced an additional figure, Fig. 4.3. This figure is a peculiar convolution of counterfactuals and data dragging to prove the authors' thesis and confirm their alleged discovery. Let me first examine the factual errors, and after that, I will scrutinize the logical fallacies committed in this figure.

The factual errors of Drs Solomon and Stearns as presented on Fig. 4.3 have been corrected by me, and a correct version of their figures is depicted on Fig. 4.4. The following errors have been found:

1. The average minimum temperatures for all the years are miscalculated,
2. The average minimum temperatures for 1988 is –39.6°F, and not –36.2°F,
3. The average minimum temperatures reported by Captain Scott was –39°F, and not –37.1°F,
4. Included in Fig. 4.3 is the data from the Ferrell (station 2) weather station (□), which is meaningless.

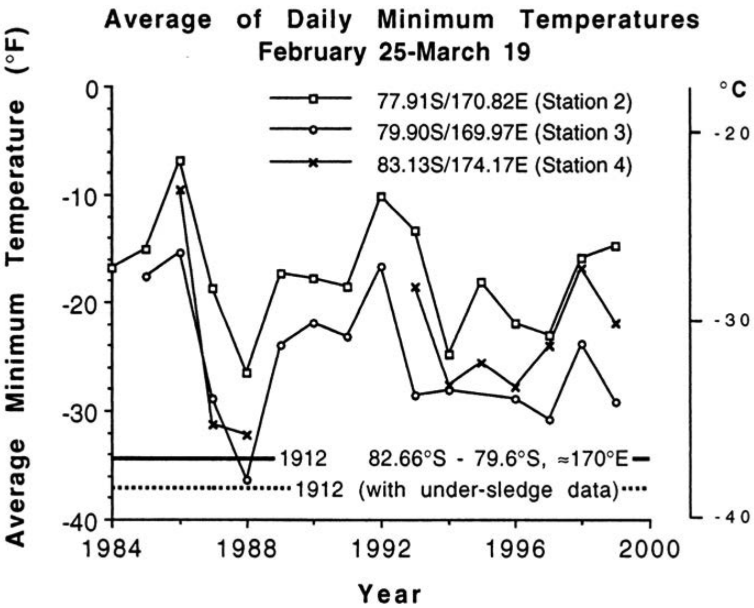


Figure 4.3. Reproduction of Drs Solomon and Stearns' figure (Fig. 4)[1] of "Average of daily minimum temperatures for February 25–March 20 on the Ross Ice Shelf. Data for 1912 both with and without the inclusion of under-sledge night time minima (see text) are compared with measurements made by the automated weather stations at 77.91°S, 79.9°S, and 83.13°S (stations 2, 3, and 4 in Fig. 1)." Reproduced with permission. © (1999) National Academy of Sciences, U.S.A.

[1] PNAS, *cf.* p. 13015.

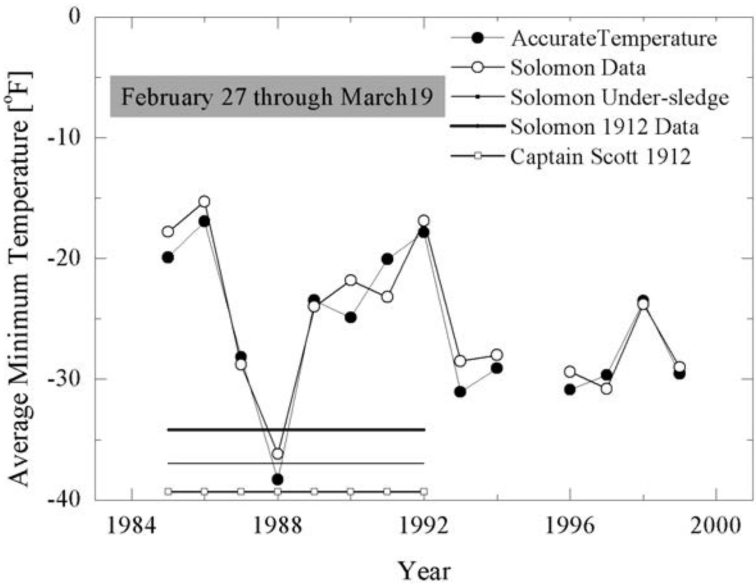


Figure 4.4. Recasting Drs Solomon and Stearns' Fig. 4 (Fig. 4.3 above), illustrating their temperature data dragging associated with the year 1988. For the symbols' meaning, look at the figure legend. The correct average minimum temperatures are calculated for the period Feb. 25th through Mar. 19th.

Depicted on Fig. 4.5 are the differences between correct (●) and Drs Solomon and Stearns' (○) minimum temperature data. Their lack of attention to details is exemplified by the fact that they did not notice that the time attributed to data at the Schwerdtfeger weather station is Coordinated Universal Time[29] (UTC), which is related to New Zealand Standard Time (NZST) by UTC+12h. The Ross Dependency in Antarctica maintains NZST/NZDT, along with McMurdo and the Amundsen-Scott South Pole Stations. The "standard time [NZST], which was twelve hours fast on GMT [Greenwich Mean Time]"[30] was used at Cape Evans and during the sledging journeys from Cape Evans.

It is especially intriguing to observe on Fig. 4.5 the differences between actual and depicted minimum temperatures points in 1988 and 1912 by Drs Solomon and Stearns. Captain Scott's actual minimum or the lowest recorded temperatures is about –39°F. Before proceeding further, let us look under Dr Solomon's carpet. Are the above-mentioned points 1 to 4 genuine errors, or data dragging to support Drs Solomon and Stearns' thesis? For the following reasons, I believe the latter.

At first, Drs Solomon and Stearns correctly describe the period of the Extreme Cold Snap as "with one exception (Mar. 4th, 1912), every day of available measurement from Feb. 27th through Mar. 19th, 1912, was characterized by daily minimum temperatures below –30°F".[31] However, instead of calculating and discussing average minimum temperatures for the *Extreme Cold Snap* duration, they extended its period by two "warm" days and analyzed temperature data from Feb. 25th through Mar. 19th. By adding "warm" days – Feb. 25th and 26th – they falsely warmed up the *Extreme Cold Snap Feb. 27th through Mar. 19th, 1912* as well as its modern counterpart(s) recorded

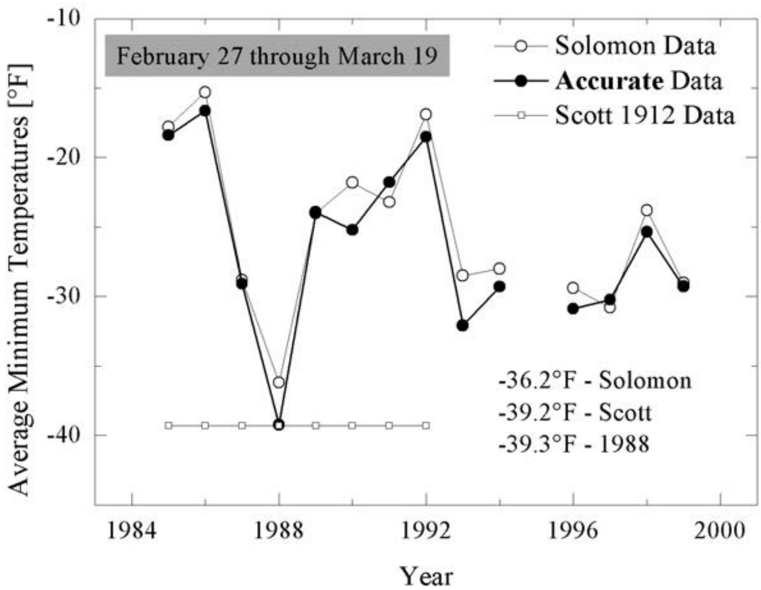


Figure 4.5. An accurate average of minimum temperatures recorded at Schwerdtfeger weather station compared to the incorrect data of Solomon and Stearns. The average of the minimum and the lowest temperatures (since Mar. 10th, 1912) reported by Captain Scott in 1912 is also indicated.

at the Schwerdtfeger weather station. In the small Tab. 4.1, I collected pertinent temperature data. One can see from this table, and from Fig. 4.5, that in addition to the above inaccuracies, the average minimum temperatures given by Drs Solomon and Stearns are erroneous.

Table 4.1. Comparison of accurate and Drs Solomon and Stearns averaged minimum temperature (in °F) data for two different periods of Feb. 25th (or 27th) through Mar. 19th. The accurate data were taken from Captain Scott's journal and Dr Simpson's Tab. 72 for 1912. The data for One Ton Depôt were taken from Schwerdtfeger weather station for the coldest year on record, 1988. Drs Solomon and Stearns' data were taken from digitized Fig. 4 of their paper in PNAS.

		25–02÷19–03	27–02÷19–03
Accurate Data	Captain Scott	–37.2	**–39.0**
	One Ton Depôt	–39.2	**–39.6**
Solomon Data	Captain Scott	–37.5	
	One Ton Depôt	–36.2	

Using this erroneous temperature data, Drs Solomon and Stearns arrived at the most important result of their work

> Fig. 4 [Fig. 4.4 and Fig. 4.3 respectively] demonstrates that the period from February 25 to March 19 of 1912 was as cold as or perhaps was the coldest

> yet recorded near 80°S, 170°E, although it must be acknowledged that the present record is limited to only 16 years [*sic*].

The authors pretend to be frank to the reader as they acknowledge their use of limited records, "only 16 years". Once again they produced a lie. They used a record of *13 complete years* of data at Schwerdtfeger weather station.[32] The number of years used in the analysis is not important, but the consequence of it is. Drs Solomon and Stearns, however, do not say and/or study what are the consequences of limited records used in the article to the conclusions drawn. The authors should use scientific tools of statistical analysis. But it is alien to them, especially to Dr Solomon who, as will see later, ignores the subject. However, analysis of physical measurement(s) without statistical analysis is simply *not acceptable* and is the authors' wishful thinking.

Based on nothing and equipped with ignorance, Drs Solomon and Stearns concluded

> Only 1 year in the modern record seems to rival [*sic*] the severity of the temperatures measured in 1912, broadly [*sic*] consistent with Simpson's conclusions that conditions would likely have been milder in roughly 9 out of 10 years. The meteorological data shown in Figs. 3 and 4 therefore reveal [*sic*] that Scott was correct rather than petulant [*sic*] when in his final message to the public he wrote, "… no one in the world would have expected the temperatures … which we encountered at this time of year" (ref. 1, p. 606).

The language used in what seems to be their final and main conclusion is indeed shocking and utterly unscientific. It is a linguistic snare, which is a fallacy, and may cause the reader to infer a false conclusion. There is a certain camouflaged purpose in such a description. The phrases "seem to rival", "broadly consistent" and/or "correct rather than petulant," are disqualifying indicators. They prove that Drs Solomon and Stearns are in the dark and unable to produce a scholarly result.

The investigative reader should notice how twisted the "logic" they use is. First, the authors falsely, as I have shown above (at the beginning of section 4.1), attribute to Dr Simpson the probabilistic locution that he figured out that Captain Scott's "nine times out of ten … would have come through: but he struck the tenth". Of course, no such notion or result was admissible from the weather data available to Dr Simpson, and he never actually said it. Having confused the reader, Drs Solomon and Stearns *confirm* that their result based on modern weather records is "broadly consistent with Simpson's conclusions"! How even "broadly consistent" can be something with a non-existent conclusion? Thus, because the results of Drs Simpson, Solomon, and Stearns are "broadly consistent" they are true and right. Captain Scott "struck the tenth," and though "no one in the world would have expected," Drs Solomon and Stearns confirmed it!

However, Drs Solomon and Stearns' conclusion was limited due to their factual errors in average minimum temperatures, and the authors pointed out that "Only 1 year in the modern record *seems to rival* [emphasis mine] the severity of the temperatures measured in 1912." If they were more careful, they would find to their joy that

> During the Extreme Cold Snap – Feb. 27th through Mar. 19th, 1912 the minimum and lowest temperatures reported by Captain Scott are almost *exactly the same* (0.6°F difference) as the minimum temperatures recorded in 1988!

The accurate data, as opposed to Drs Solomon and Stearns' data as depicted on Figs. 4.2 and 4.3, are shown on Fig. 4.5 and in Tab. 4.1.

Paraphrasing Drs Solomon and Stearns' revealing line – with my non-quibbles presented above – I summarize that only 1 year in the modern record almost *exactly* matches (with six-tenth °F difference) the severity of the temperatures measured in 1912. Using their language and thinking, I say that this stunning coincidence *entirely* confirms that "Scott was correct rather than petulant when in his final message to the public." Indeed, it is a specious argument used for deception.

However, if I use my thinking and my knowledge, I must say that the above coincidence of averaged temperatures in 1988 and 1912 proves *nothing*, nothing as far as confirmation of the *Extreme Cold Snap*. It rather proves that "one can calculate the motion of heavenly bodies, but not the madness of people."[33]

It is congenial moment to recall the American philosopher, logician, mathematician, and scientist Charles Peirce [34] who in his important book finely entitled *Chance, Love and Logic* addressed his concerns[35]

> I have given the reader such a dose of mathematics, psychology, and all that is most abstruse, that I fear he may already have left me, and that what I am now writing is for the compositor and proof-reader exclusively. I trusted to the importance of the subject. There is no royal road to logic, and really valuable ideas can only be had at the price of close attention. The reader who has been at the pains of wading through this paper, shall be rewarded in the next one by seeing how beautifully what has been developed in this tedious way can be applied to the ascertainment of the rules of scientific reasoning.

Let us look at the probabilistic justification of Drs Solomon and Stearns' discovery summarizing that "conditions would likely have been milder in roughly 9 out of 10 years." However, the appeal of this conclusion to probability is an intentional lie. The idea of probability belongs to inference, which is *repeated* indefinitely. For a single case considered in itself, probability can have no meaning. Therefore, Drs Solomon and Stearns' argument of alleged confirmation of the *Extreme Cold Snap* in 1912 is a falsehood, and not supported by any argument.

The investigative reader may wonder about a hypothetical case when, for example, the Schwerdtfeger weather station was in 1988 not operational due to a malfunction and the data was not available to Drs Solomon and Stearns. What conclusion, using their reasoning, would they present? Would they conclude that the *Extreme Cold Snap* described by Captain Scott did not happen, or would they pick the next year, say 1993 (see Fig. 4.4) and continue the previous argument that "only 1 year (1993) in the modern record seems to rival the severity of the temperatures measured in 1912." However, if for additional reasons the temperature data for 1993 was missing, would they select a year, say 1996, to confirm the *Extreme Cold Snap*? What is a scientific measure of Drs Solomon and Stearns' gobbledy-

gook judgment of "broad consistency" of modern and Captain Scott's temperature data points?

Aristotle, in his *Sophistical Refutations* (*Sophistici Elenchi*)[36], identified thirteen fallacies: five linguistic and eight non-linguistic. Within the former group, the fallacy called *Affirming the Consequent* is the most common. A non-linguistic fallacy is an improper argumentation in reasoning, which leads to an argument being invalid. The structure of affirming the consequent fallacy is:

$$\boxed{\text{If } \mathcal{A} \text{ is true then } \mathcal{B} \text{ is true. } \mathcal{B} \text{ is true. Therefore } \mathcal{A} \text{ is true.}}$$

where $\mathcal{A}$ called the antecedent and $\mathcal{B}$ the consequent. The fallacy of the above statement results from hidden assumption that an if … then … statement is commutative, that is for a given statement *If* $\mathcal{A}$ *then* $\mathcal{B}$, you can also reverse it to state *If* $\mathcal{B}$ *then* $\mathcal{A}$.

An example of affirming the consequent fallacy is:

I am at the South Pole.
The South Pole is in Antarctica.
I am in Antarctica, therefore I am at the South Pole.

This example clearly shows that in the above statement if … then … is *not-commutative*. The South Pole is in Antarctica, but not every point of Antarctica is located at the South Pole. Perhaps the most famous example of non-commuting operators can be found in quantum mechanics (linear momentum (p) and the position (x)) as expressed by Dr Heisenberg's uncertainty principle $\left(\Delta p_x \cdot \Delta x \geq \hbar/2\right)$.

Figure 4.6. An illustration effects of gale force wind on land objects, by Dr Simpson.[1]

[1] http://www.metoffice.gov.uk/media/pdf/4/4/Fact_Sheet_No._6_-_Beaufort_Scale.pdf

Equipped with Aristotle's affirming the consequent fallacy, let me recast the already mentioned above Drs Solomon and Stearns conclusion that

> Only 1 year in the modern record seems to rival the severity of the temperatures measured in 1912 … The meteorological data shown in Figs. 3 and 4 therefore reveal that Scott was correct …

into a more concise and transparent form:

Argument 1

> If the 1912 strike is true, then the 1988 strike is true. The 1988 strike is true. Therefore, the 1912 strike is true.

The fallacious construction of the above is evident. Therefore, Drs Solomon and Stearns' conjecture is fallacious and false. There is no logical way to support their "discovery" by fallacious reasoning. Thus, on the basis of a lack of probabilistic argument and fallacious affirming, Drs Solomon and Stearns' alleged confirmation of the Extreme Cold Snap in late February through March 1912 must be refuted.

The above disqualifying difficulties with Drs Solomon and Stearns' conclusions are classified as a formal fallacy and error in statistical analysis. These fallacies are easily detected and have been known since the time of Aristotle.

4.1.2. Wind Data Dragging

Towards the end of Drs Solomon and Stearns' paper in PNAS, the authors presented a crucible of counterfactuals in an attempt to prove the gale described by Captain Scott at the location of the last camp was a common and observable condition. Let me here remind you briefly what was originally written by Captain Scott in regard to the weather events towards the end of March 1912.

Captain Scott and his journal tell us, "Thursday, March 29. – Since the 21st we have had a continuous gale [*sic*] from W.S.W. and S.W.," and continues "Every day we have been ready to start for our depot 11 miles away, but outside the door of the tent it remains a scene of whirling drift."[37]

Indeed, not much of a descriptive account, but provided that it is dated Mar. 29th, one must admire Captain Scott's clarity in writing and describing the weather. Captain Scott not only gives the prevailing wind direction, but also wind velocities. The accuracy of prevailing wind directions given by Captain Scott as "W.S.W and S.W." is indeed confirmed by weather data collected at the Schwerdtfeger weather station. However, the wind direction is not Drs Solomon and Stearns' concern. Its velocity and duration bothers them the most. For the Royal Navy officer, the knowledge and the use of the Beaufort wind force scale was a part of training and subsequent usage. Therefore, the wind reported by Captain Scott was gale force, which is defined as a wind velocity between 17–21 m/s (about 62–74 km/h or 39–46 mph). See Fig. 4.6. Having this gale wind velocity in mind, let me cite Drs Solomon and Stearns' expound of Captain Scott's above-mentioned account[38]

> A blizzard [*sic*] began on March 20 (ref. 1, *cf.* p. 594–595). This storm [*sic*] ended [*sic*] the attempt to continue marching at a site about 11 geographic miles

> (12.66 statute miles) from the next depot containing food and fuel (ref. 2, *cf.* p. 495–498). Scott's diary is not specific [*sic*] as to the wind speeds during this period, but he emphasized that windy conditions [*sic*] persisted until his final diary entry on March 29. Peak daily winds in excess of 30 km/hour for 7 or more consecutive days have occurred in March during half of the years of available observations (from 1986–1999) by the automated weather station at 79.9°S, with as many as 10 such days being recorded in 3 years. Hence, windy conditions do not appear to be highly unusual for this location and time of year.

Because Drs Solomon and Stearns want to prove that Captain Scott's account is indeed truthful, they produce a cynical lie by saying that

> Scott's diary is not specific as to the wind speeds during this period, but he emphasized that windy [*sic*] conditions persisted until his final diary entry on March 29.

It is indeed a foolhardy proposition. Captain Scott on Mar. 29th, 1912 did write in his diary "Since the 21st we have had a continuous gale". Can anyone, including Captain Scott, be more specific than that? The wind velocities of a gale are about 62–74 km/h.

After *eliminating* Captain Scott's reference to a "continuous gale," Drs Solomon and Stearns proceeded with their proof of how frequent was the "storm [*sic*][39] " which "ended the attempt to continue marching at a site about 11 geographical miles"[40]

> Peak daily winds in excess of 30 km/hour for 7 or more consecutive days have occurred in March during half of the years of available observations (from 1986–1999) by the automated weather station at 79.9°S, with as many as 10 such days being recorded in 3 years.

It is indeed data fabrication. By *assuming* in their thesis a wind velocity of 30 km/h – *fresh breeze* in the Beaufort scale – they reduce the threshold for a gale to about *half* of what Captain Scott reported. Thus with a fraudulent search criterion, Drs Solomon and Stearns searched the period 1986–1999 at Schwerdtfeger weather station (–79.904) for winds lasting for 7 days or more.

To sum up their revelations, Drs Solomon and Stearns finally observed that "Hence, windy conditions do not appear to be highly unusual for this location and time of year." They assumed that "windy conditions" are in fact highly usual for the geographical location where Captain Scott and his companions perished. Therefore, Drs Solomon and Stearns confirmed Captain Scott's account of the 9/10 day blizzard.

The above subsections summarize Drs Solomon and Stearns' "scholarly" publication in Proceedings of the National Academy of Science. Indeed, a very scary piece of research. Their work is an example of scientific misconduct where by producing false data the researchers prove their scenario.

4.2. The Coldest March – Not Even Wrong

Dr Solomon's revelations, published in the Proceedings of the National Academy of Sciences (USA), are indeed a chilling piece of research. Subject to journalistic format-

ting constraints, the article's length, and the limited number of authors' comments, analyses, and interpretations, we are left with an erroneous, poorly investigated thesis on the Scott expedition.

It appears also that the paper did not receive much interest with polar enthusiasts. After all, who among them was reading obscure general public publications in PNAS? I can assume that I was the only one, who back in 1999 carefully (?) read the paper.[41] I am certain that I was the only one who submitted critical comments about the paper to the Editor and to the authors to point out the errors and half-truths in published manuscripts.

Behind every published book, there is an author with his/her reasons and motivations to have the courage to write it. I did mention my personal motives in my Prolegomenon. Two years after the PNAS publication, Dr Solomon followed the subject with the book under the prepossessing and double-entendre title *The Coldest March: Scott's Fatal Antarctic Expedition*.[42] Dr Solomon was eager to stress that her book was a result of many years of research. While interviewed for the *New Scientist*, she was asked how she came to "conclusion that all [*sic*] the doubters were wrong"[43]

> It took about 15 [*sic*] years of research. First I read the diaries and everything else I could find, then I collected the expedition's data and compared it with modern data. Than I had one of those wonderful moments of scientific epiphany when you say: "Oh my gosh, I understand this now." No one could have predicted the persistent cold weather that Scott faced. In 17 [*sic*] years of direct data from the area where he died, there's only been one year like that. George Simpson, Scott's meteorologist, was convinced that the weather was highly unusual, but he couldn't prove it and I could [*sic*]. That's when I knew I had to write this book.

Indeed, a startling confession. Dr Solomon, without a twinge of conscience, tells us that Dr Stearns[44] as a contributor to the PNAS paper was a straw man. Now we know who is to blame. Right from the start, her motives are indeed clear. First, she must overdo anything she does. Thus, she confabulates the length of her research on the subject and the length of weather data available from the Schwerdtfeger weather station. If Dr Solomon was a meticulous scholar at the time of the book's publication, she would have had 13 + 2 (or 1) years of data from this station. However, because she did not update her figures after the PNAS publication, she effectively used in her book 13 years of data, and not 17 years as she told the interviewer. That is about a 25% increase! Dr Solomon claims she studied 15 years of research data to find out which year out of 13 daily minimum temperature records of the length Feb. 25th trough Mar. 19th was the coldest one. She came up with the result that the year 1988 was the coldest between all remaining ones. Since Dr Solomon was an affiliate scientist (1992–2006) at the National Center for Atmospheric Research, Boulder, the American taxpayer must be seriously concerned. Dr Solomon needed more than one year to calculate a mathematical average of 24 temperature data points for each year! A spreadsheet in Microsoft Excel does it in a split second.

Dr Solomon's book *The Coldest March*, in contrast with her fallacious and spurious article in PNAS, received wider interest. *The Coldest March* was reviewed in journals and newspapers.[45] A TV program was produced and broadcasted in various editions by PBS and BBC. Her book received many shorthanded descriptions: science

demolishing prejudice, researched vindication of Scott, detective story[46], or the worst weather in the world by paraphrasing the Cherry-Garrard book title *The Worst Journey in the World*.

However, did anyone actually read Dr Solomon's book? Fallacies are not only mistakes; they are seductive mistakes. Right from the beginning, Dr Solomon, while describing the *Terra Nova's* journey to Antarctica, presents her fallacious methods later repeated *many* times in different contexts. Firstly, Dr Solomon pointlessly compares the *Terra Nova*'s passage time through the Ross Ice pack[47]

> *Terra Nova* arduously worked its way through the dense ice pack to more navigable waters between December 9 and 30. Amundsen and his men crossed the pack in only five days, January 2–6, 1911, finding it "so loose that we were able to hold our course and keep up out speed for practically the whole time". Shackleton had cleared it in just two days, January 16–17, 1908.

Her comparison between these three expeditions is meaningless because:

- the seaworthiness of *Fram*, *Nimrod*, and *Terra Nova* were different,
- all expeditions entered the sea pack at different longitudes,
- all expeditions entered the sea pack at different times of the year,
- all expeditions entered the sea pack in different years.

Despite that, Dr Solomon eagerly continues to show the power of science in proving Captain Scott's account

> The contrast of Scott's three weeks stuck in the pack may be interpreted as evidence of gross miscalculation even in his seamanship. But today's [*sic*] science sheds important light on this part of the legend [*sic*], for it shows that Scott's troubles stemmed not from poor sailing acumen but from the inexorable physics [*sic*] that drives the sudden seasonal breakup of the ice that forms a wall around the Antarctic each year. *Terra Nova* tried to push her way through the ice blockade prematurely – in early December, rather than January.

However, her logic is fallacious. Even at the actual time, and without "modern science," one with common sense would understand that the state of the sea ice pack in the Ross Sea area is a result of many highly variable factors, like temperature, winds, location, and time of year (season). The spatiotemporal variability of ice-ocean-atmosphere-solar processes is great. Therefore, the crossing time of the pack is also a spatiotemporal variable.

But I am not concerned here with the physics of the pack at the Ross Sea. I am concerned with Dr Solomon's logic. First, she is producing her own bizarre interpretation of Captain Scott's time of passage through the pack as a result of "miscalculation even in his seamanship." Then she formulates a thesis that "today's [*sic*] science sheds important light on this part of the legend [*sic*]". The key of the thesis is the existence of an unspecified "legend," implicitly about Captain Scott. After that, by using satellite data to illustrate "seasonal decay of the sea ice during the 1999–2000 austral summer," she is "proving" that indeed Captain Scott's attempt to cross the ice pack was premature. However, she is not saying what these satellite images of 1999–2000 have

to do with data of 1910–1911 weather and pack in the Ross Sea! It is indeed a hasty generalization logical fallacy of reaching conclusions based on insufficient or unrelated evidence. However, it is not only that which raises suspicions about her thesis. It is misperception and misinterpretation of incomplete and under-representative data. Something out of nothing, and too much from too little.

4.2.1. Dr Solomon – Weather and Climate Tantamount

Dr Solomon's Cherry Picking Fallacy, as mentioned above, in relation to her "analysis" of Captain Scott's journey across the Ross Sea, is only one example of the many fallacies and bizarre logical interpretations present in her book. Indeed, the very title of the book, *The Coldest March*, is fallacious, as no evidence is presented to support its *coldest* notion.

The foundation of Dr Solomon's plot is camouflaged by her continuous mixing and confusing issues related to climate and weather. In relation to this matter and method, she followed Dr Simpson's approach, whose achievements and errors I described in Chapter 3. The crucial part of Dr Solomon's book is to persuade the reader that Dr Simpson, and thus Captain Scott, had *true insight* into the meteorology of Antarctica, and that the modern meteorological research confirms it. However, according to Dr Solomon and her alleged knowledge, they could not predict the "unexpected" *Extreme Cold Snap*. Such fallacious reasoning echoes Captain Scott's assessment from his *Message to the Public*, namely

> I maintain that our arrangements for returning were quite adequate, and that no one in the world would have expected the temperatures and surfaces which we encountered at this time of the year.

Although ceding all difficulties on weather may be pleasurable, the pertinent questions must be answered. Certainly, Dr Solomon was not interested and equipped with the knowledge to critically examine Dr Simpson's work related to the Captain Scott expedition. Instead, Dr Solomon presents a whole chain of unsubstantiated claims about Dr Simpson

> Simpson laid the groundwork for understanding the factors that control surface temperature in Antarctic winter [*sic*], the conditions that would determine the survival of any party trying to attain the Pole[48]

> … it was Simpson who weighed and evaluated the meteorological challenges that the polar party would be likely to encounter[49]

> Putting this information together, Simpson estimated the average annual cycle of temperatures to be expected [*sic*] on the Barrier.[50]

> Recent data reveal [reveals] that Simpson's 1919 estimate was stunning in its accuracy, as shown in figure 37. Scott and his men gathered enough data for Simpson to surmise precisely what average conditions would be like deep in the heart of the Barrier throughout the year[51] Simpson pored over the expedition's meteorological records with care, devoting considerable attention to such key technical matters as instrument design, precision and calibration.[52]

All the above enthusiastic but unscientific accounts of Dr Simpson's work do not even attempt to provide a critical analysis, like I have done in Chapter 3. Therefore, Dr Solomon's above observations are false, untrue, and fallacious. The inability of Dr Solomon to distinguish between climate and weather data is horrific. Suggesting, without reflection on the fact of the very few temperature data points, that Dr Simpson's "estimate was stunning in its accuracy" is an unforgivable error on Dr Solomon's part. Is she indeed suggesting that four (4) temperature readings from September and October 1911[53] are sufficient to get "stunning … accuracy"? Although Dr Solomon is not telling what measure of accuracy she is proposing, the answer to this question is affirmative. Let us look more carefully at her Fig. 36, as I depicted on my Fig. 4.7. Three specious issues are pertinent to this figure and related to Dr Solomon's analysis. These seemingly well-reasoned but actually deceptive concerns are:

- Comparison of temperatures at non-interchangeable geographical locations,
- Inaccuracy of temperature data from automated weather stations,
- Data dragging and data falsification.

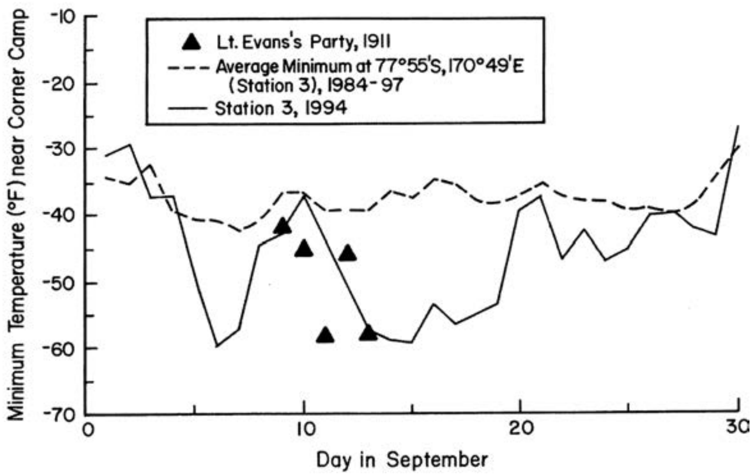


Figure 4.7. What follows is the original figure caption text from Dr Solomon's book.[1] "Minimum temperatures in September from the automated weather station at 77°55′S, 170°49′E, near [*sic*] Corner Camp (station 3; see map 2), compared with Lieutenant Evans's 1911 data." © Yale University Press.

[1] Susan Solomon, *The Coldest March: Scott's Fatal Antarctic Expedition*, Yale University Press, New Haven and London, 2001, *cf.* p. 161.

The first specious matter is that Dr Solomon compares minimum temperatures recorded at distant locations of Corner Camp 77°54′S and 167°17′E and the automated weather station named Ferrell (IP-8929) located at 77°55′S and 170°49′E. The comparison is made to show that[54]

> These minimum temperatures [recorded by Lt Evans' party] were colder than average for the region near Corner Camp (fig. 36), but within the range of typical variability [*sic*] for the coreless winter's September.

Dr Solomon does not provide a meteorological rationale for comparison of temperatures at these distant locations. One can easily calculate the distance between these locations, with the result being equal to 57.3 geographical miles. The provided observed gradient of temperatures between Hut Point and the Barrier and the study of temperatures in the vicinity of the Ross Island is a must for her conclusions, otherwise she is playing with the Cherry Picking fallacy. Calling one year (1994) of minimum temperature changes as a typical variability is a meteorological fallacy produced by Dr Solomon.

Even in this most simple case, Dr Solomon is unable to report accurate temperatures recorded at the Ferrell weather station in 1994. On Fig. 4.8, I presented a comparison of the correct data and Dr Solomon's data at the Ferrell weather station. The conclusions are palpable.

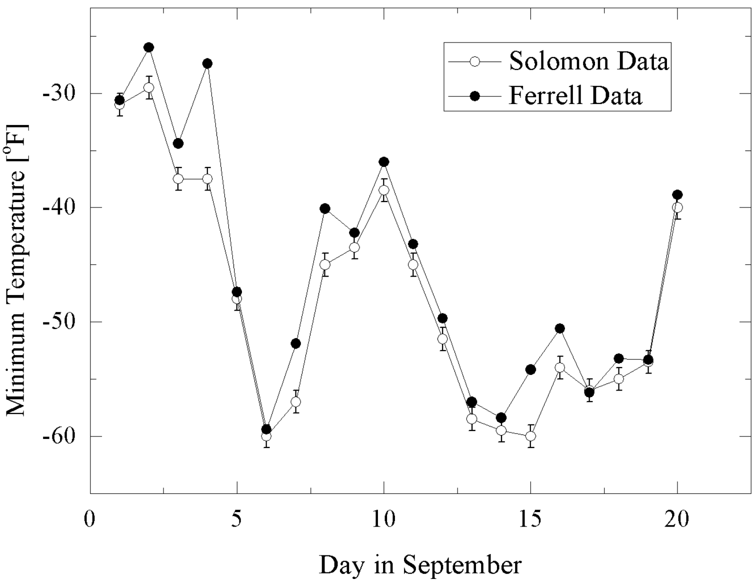


Figure 4.8. Comparison of minimum near surface daily temperatures record at the Ferrell automated weather station, and the respective temperature data presented by Dr Solomon on her Fig. 36. See Fig. 4.7. The error bars presented on the figure are standard errors obtained from my digitization of Dr Solomon's figure data.

The trouble with Dr Solomon's presentation on Fig. 4.7 concerns her data dragging and data falsification in relation to Lt Evans party during the journey from Hut Point to Corner Camp and back in Sep. 9th through 15th, 1911. Lt Evans noted his trip's purpose[55]

> Previous to the departure of the large caravan for the Polar journey, a spring journey was proposed for the purpose of laying a small depot at Corner Camp and generally reconnoitring. On account of the low spring temperatures no animals were used for this trip, which was carried out by Gran, Forde, and myself.

During the 7-day journey, his party recorded temperatures, but not always the daily minimum temperatures. For four days – Sep. 10th through 13th – the party reported daily minimum temperatures. However, for the remaining days, only temporary temperature records are available.[56] Therefore, Dr Solomon was incorrect by identifying these data points as daily minimum temperatures.

On Fig. 4.9, I depicted both Dr Solomon's data and the correct data taken from Dr Simpson's Vol. III.[57] With the caveat as described above, one can see that Dr Solomon not only inaccurately presented data points but also removed two temperature points and compressed three points for a better fit to her 1994 data. It is evident that Dr Solomon dragged temperature data to be closer to the 1994 record at the remote Ferrell automated weather station.

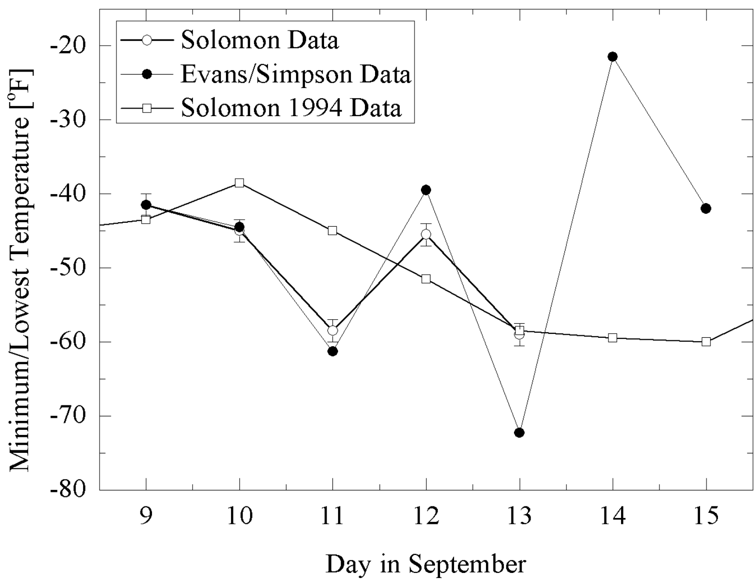


Figure 4.9. Comparison of Dr Solomon's temperature data as depicted on her Fig. 4.7 with Evans/Simpson's correct temperature record. Note that the minimum temperatures are only available for Sep. 10th through 13th, 1911. Thus, the remaining Lt Evans party's record depicts the lowest temperature recorded. The error bar was calculated as for Fig. 4.8.

It must also be noted that Dr Solomon on Fig. 4.7 presented incorrect averaged minimum temperatures at Ferrell station. She indicates on this figure that the average concerns the period 1984–1997. No data for this station are available for 1991, and for the years 1990 and 1995, only half of the data points in September are present.

Dr Solomon not only confuses weather with climate, but also fails to differentiate what was known about the meteorology of Antarctica during the planning stages and after. But even more importantly, Dr Solomon fails to understand that even today, one cannot plan the weather in Antarctica. She makes a present bias error. Captain Scott's and Dr Simpson's experiences could only diverge from their expectations due to their very limited knowledge about the weather during the South Pole journey. However, by no means was Captain Scott's journey in its planning stage weather-

driven. He did not have data or tacit knowledge as to what to expect in regard to temperatures, wind velocities, and their frequency. Virtually all the meteorological data collected during his expedition on the Barrier during the *Discovery Expedition* and the Shackleton records did not give any reasonable insight into the *variability* of the weather. Captain Scott and/or Dr Simpson did not have the knowledge in regard to the range of temperature and wind changes. The more so, because Captain Scott's comments like[58]

> It seems undeserved where plans were well laid and so nearly crowned with a first success. I cannot see that any plan would be altered if it were to do again, the margin for bad weather was ample according to all experience, and this stormy December our finest month is a thing that the most cautious organiser might not have been prepared to encounter.

are an entirely poetic description, and not a scientifically minded account. More importantly, these comments show how Captain Scott confused weather and climate arguments, and how Dr Solomon uncritically promoted this tantamount.

4.2.2. Dr Solomon's Fabrication of Meteorological Data

The mess presented by Dr Solomon on her Fig. 49 represents the illustrative spirit of her manipulations with data, false analysis, unscientific reasoning, and manipulative data dragging to prove her case that Captain Scott was indeed struck by unusual weather during the South Pole journey. For the sake of clarity of the following critical examination, I have exactly reproduced Dr Solomon's Fig. 49, as depicted on Fig. 4.10. The analysis will clearly show Dr Solomon's intention and gross negligence leading to fabrication of the scientific message resulting from meteorological data.

Fig. 4.10 was produced by Dr Solomon in the context of temperature differences encountered (observed) by Captain Amundsen and Captain Scott's teams in the vicinity of the South Pole. Her case and intention are spelled out in her book[59]

> On Sunday, January 14, the party passed latitude 89°20′ at lunch, and Scott noted that they were all feeling the cold. The minimum temperature that day was –19°F, considerably colder than the conditions Amundsen had experienced a month earlier (see fig. 49) [Fig. 4.10 – KS].

It does not take a great effort for the investigative reader to consult Captain Scott's original journal entry for Jan. 14th, 1912, which starts with temporary temperature readings "Camp 66. Lunch T. –18°, Night T. –15°". Not a trace of the minimum temperature of –19°F reported by Dr Solomon. While digging further, one may consult Dr Simpson's collection of the Captain Scott temperature data, and one would find Lt Bowers' record for this particular day, {hour, temperature} = {6, –22.8°, 13:30, –18.6°, 20, –15.4°}F. By taking a mathematical average for these *three* readings, one can get an average temperature of about –19°F during the *daytime*. Of course, this is obtained in such a way that the average temperature is not true minimum near surface temperature during the *daytime* for Jan. 14th, 1912. The true daytime temperature would be measured by a minimum temperature thermometer set in the morning hour and read at the end of the daytime. Provided that Captain Scott on

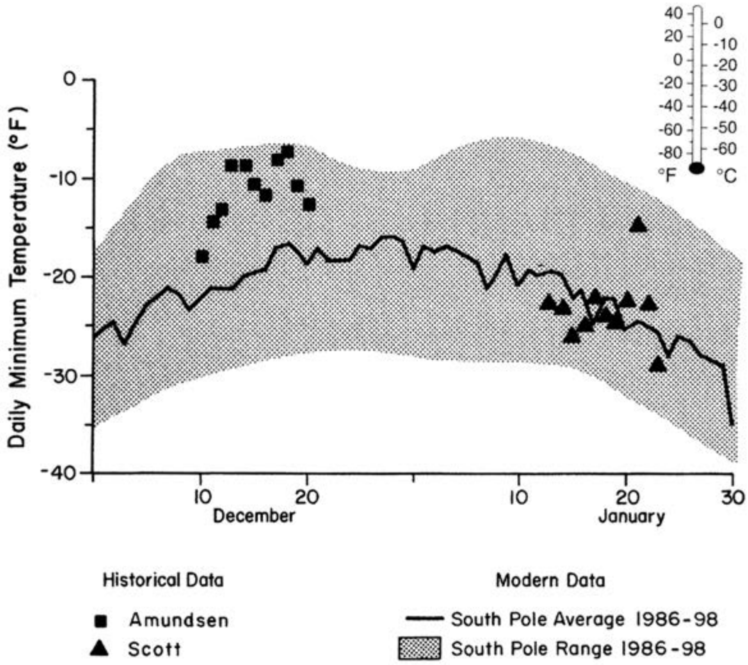


Figure 4.10. What follows is the original figure caption from Dr Solomon's book.[1] "Figure 49. Daily minimum temperatures recorded by Amundsen's and Scott's parties within one degree of latitude of the South Pole, compared to the averages and the ranges recorded by automated weather station data. Amundsen's data happens to lie on the warm edge of the range, while Scott's are generally near the mean, with the exception of one warm day. This difference in the luck [*sic*] of their circumstances, combined with Amundsen's earlier arrival, led to an overall difference on more than ten degrees in the average minimum temperatures experienced by the two groups at the Pole." © Yale University Press.

[1] Susan Solomon, *The Coldest March: Scott's Fatal Antarctic Expedition*, Yale University Press, New Haven and London, 2001, *cf.* p. 215.

this day was at –89.34805, the Sun was 24h above the horizon. Thus, his daytime was estimated by NZST – New Zealand Standard Time – 06:15 Sun Rise and 20:41 Sun Set – Auckland on Jan. 14th, 1912.

The above inaccurate temperature record could be viewed as a lack of precision in writing. However, Dr Solomon's conjuncture that the cold, as recorded by Captain Scott, calculated by Dr Solomon to be –19°F and being "considerably colder" than Captain Amundsen's record, as depicted on Fig. 4.10 (Fig. 49 in Dr Solomon's book), is bogus reasoning and arguing.

Dr Solomon placed words in Captain Scott's mouth by saying that "Scott noted that they were all feeling the cold," and makes a junction that it was due to low temperatures. Captain Scott in his Jan. 14th journal entry was rather direct about the reason for feeling cold

> Again we noticed the cold; at lunch to-day (Obs.: Lat. 89°20′53″ S.) all our feet were cold, but this was mainly due to the bald state of our finnesko.

Dr Solomon's most glaring suggestion comes from the statement that the minimum temperature –19°F was "considerably colder than the conditions Amundsen had experienced a month earlier". To support her observation, Dr Solomon produced Fig. 49 (see Fig. 4.10 above), a bizarre mixture of temperature data: minimum daily temperatures (Captain Scott), temporary temperatures (Captain Amundsen), average minimum daily temperature (modern data for the South Pole), and variability of minimum daily temperatures at the South Pole (modern data). In Dr Solomon's presentation, the data depicted on this figure confirm her concealed thesis that Captain Scott's team experienced significantly worse conditions than Captain Amundsen's team, and thus Captain Scott was against the elements.

Dr Solomon gives no reference to where temperature data was taken. However, one can make an educated guess for all data sources, *except* for the temperature data attributed to Captain Amundsen's expedition.

The data points, as well as the caption of Fig. 4.10, make reference to daily minimum temperature. However, Captain Amundsen *never* reported minimum temperature records, as the respective minimum temperature thermometers for unclear reasons *were not taken* by the expedition.[60] Moreover, at the time of Dr Solomon's book publication in 2001, the only source of Captain Amundsen's expedition temperature data was available from his two volume published account of the journey, none of which was from his polar journey.[61] In Tab. 4.2, I summarized the temporary temperature records found in Captain Amundsen's printed account of the *South Pole Journey* in Dec. 10th through 20th, 1911. In the same table, I also added the temperature data attributed to Captain Amundsen by Dr Solomon. This data was obtained by careful digitization of Dr Solomon's figure. Not even one of Dr Solomon's data overlaps with Captain Amundsen's actual record. Additionally, for Dec. 13th, 15th, 16th, 18th and 20th Captain Amundsen *did not* record temperatures in his printed record. I have *no answer* to the question of from what original source Dr Solomon assembled the temperature data for the just mentioned dates in December 1911.

It was Olav O. Bjaaland who, similar to Lt Bowers, kept meteorological records during the South Pole journey. His journal was not published until recently.[62] Certainly Dr Solomon did not have access to it, and she did not make reference to Bjjaland's diary. The respective temperature entries from Bjaaland's journal are added to the previously mentioned Tab. 4.2. The gaps present in Captain Amindsen's record are filled with false temperatures by Dr Solomon! Bjaaland's temperatures are *temporary* records at different times of the day, and *are not* minimum temperatures as incorrectly suggested by Dr Solomon. As we are certain of Captain Amundsen's and Bjaaland's figures, one must conclude that Dr Solomon, not having original data sources, deliberately fabricated Captain Amundsen's temperature figures to produce the impression that Captain Scott faced conditions at the South Pole *much colder* then Captain Amundsen did while there.

Provided that the most frequently recorded minimum temperature is during the night hours, as I have shown on Fig. 3.5, one, by looking at Captain Amundsen and Bjaaland's entries in Tab. 4.2 can make an educated speculation that the respective minimum temperatures were substantially lower than the day temperatures, and in reality were closer to long-term averages obtained from modern data recorded at Amundsen-Scott Base and depicted by the solid line on Fig. 4.10. Therefore, both

Table 4.2. Comparison of Captain Amundsen and Bjaaland's temperature data with the data falsely attributed to them by Dr Solomon. All temperatures are in °F. Additionally there is a comparison of Captain Scott's actual temperature data with those attributed by Dr Solomon.

Date/1911	Amundsen[1]	Bjaaland[2]	Solomon[3]	Date/1912	Solomon	Scott/ Simpson
Dec. 10th	–18.4	–18.4, –18.4, –20.2	–18	Jan.13th	–22.6	–23.2
Dec. 11th	–13, 18.4	–18.4, –18.4	–14.1	Jan. 14th	–23.1	–23.5
Dec. 12th	–, –13	–11.2, –14.8, –14.8	–13.3	Jan. 15th	–26.2	–26
Dec. 13th	–, –	–10.3, –10,3	–8.7	Jan. 16th	–24.9	–27.6
Dec. 14th	–, –9.4	–9.4, –9.4, –9.4	–8.7	Jan. 17th	–22.1	–, (lowest) –21.8
Dec. 15th	–, –	–5.8, –9.4, –5.8	–10.5	Jan. 18th	–24	–23.6
Dec. 16th	–, –	–7.6	–11.8	Jan. 19th	–24.6	–26,7
Dec. 17th	–, –13	–5.8	–8.2	Jan. 20th	–22.3	–25.6
Dec. 18th	–, –	–7.6	–7.4	Jan. 21st	–14.9	–, (lowest) –14.6
Dec. 19th	–2.2, –2.2	–2.2	–10.8	Jan. 22nd	–22.6	–22.5
Dec. 20th	–, –	–11.7, –6.2	–12.8	Jan. 23rd	–29	–29.7

[1] The first entry is from Captain Amundsen's book, the second entry is from Captain Amundsen's diary.
[2] Roland Huntford, *Race for the South Pole: The Expedition Diaries of Scott and Amundsen*, Continuum, London, 2010.
[3] Digitized data from Dr Solomon's Fig. 49, page 215. See Fig. 4.10 in here.

Captain Amundsen's and Captain Scott's minimum temperature data are uniformly scattered around long term averages of minimum temperature at the proximity of the South Pole. This is contrary to the false conclusion by Dr Solomon that the difference between Captain Amundsen and Captain Scott's minimum temperatures was 'more than ten degrees'.[63]

To finish this critical examination of Dr Solomon's Fig. 4.10 and associated cluster of unscientific conclusions, one has to notice the pointlessness of comparing averages with temporary temperature measurements. Should temporary measurements be scattered in a certain way around the average? What is the relationship between mean minimum temperature (Captain Scott) and mean daily temperature (Captain Amundsen)? Why should Captain Scott and Captain Amundsen's teams record the same or similar temperatures? What is the relationship between luck and temperature, according to Dr Solomon?

One can ask similar questions for almost every figure data presented in Dr Solomon's book. To illustrate her carelessness in dealing with scientific records

of both expeditions, let me show the correct and Dr Solomon – produced figures depicting the distance travelled by the Captain Scott party. Fig. 4.11 depicts a comparison of Dr Solomon's data points taken from her digitized Fig. 43 depicting rates of progress of the Captain Scott team on the Barrier in 1911. In addition to the Solomon's data on the same figure (Fig. 4.11), I also depicted Captain Scott's actual distances. It is evident from this figure that Dr Solomon carelessly presented Captain Scott's data.

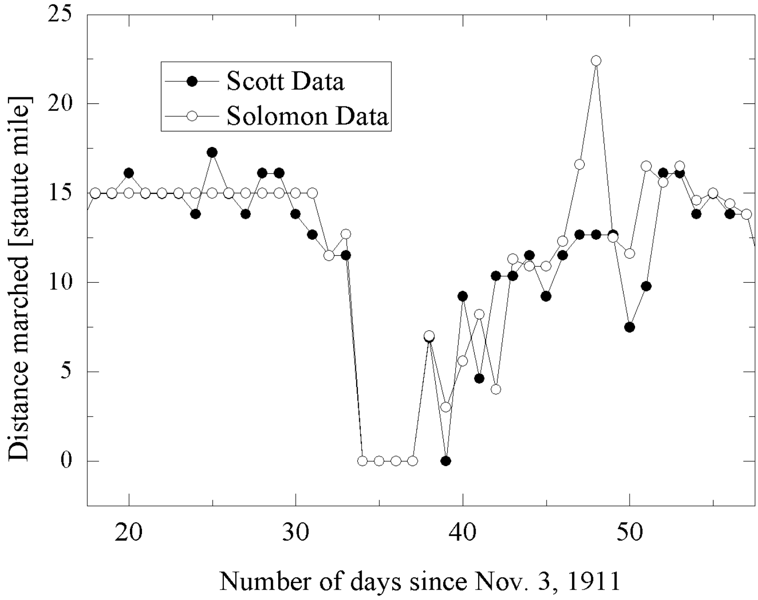


Figure 4.11. Comparison of the actual (●) and given by Dr Solomon (○) data of distance travelled by Captain Scott's party since Nov. 3rd, 1911.

Altogether in her book, Dr Solomon produced about 18 figures (plots) depicting various temperature records and temperature comparisons directly related to the *Terra Nova* and *Discovery Expeditions*. *Not one* of these figures depicted true temperature (or otherwise) data. In Chapter 14, titled *Appendixes*, I have presented a detailed analysis of Dr Solomon's errors and data dragging (Appendix 3).

To finish this subsection, I wish to point out one of Dr Solomon's biggest factual errors and lies to the readers of her book, where she corruptly argues in support of the *Extreme Cold Snap*[64]

> … support for these cold conditions is provided in Simpson's measurements of unusually cold days at Cape Evans at the same time.[14]

Reference 14 in the above Dr Solomon line is referring to Dr Simpson Vol. III, *Table 1. Temperature- Hourly Values* at Cape Evans in March 1912. However, even a cursory examination of temperature data in this table does not support Dr Solomon's lie that Captain Scott's *Extreme Cold Snap* was also recorded at Cape Evans. Nothing special or specific was happening with temperatures at Cape Evans in March 1912,

and the reader may consult section 3.3, and the respective figures (Fig. 3.15 and 3.16), where detailed comparison and discussion of temperatures have been presented. The *Extreme Cold Snap* was *confined* to Captain Scott's location(s), and as I will show later, to his diary and meteorological record.

One more observation related to Fig. 4.10 begs for an important comment. The investigative reader may look simultaneously at two Dr Solomon's figures, Fig. 4.10 which appeared in her book, and Fig. 4.2 which appeared in her PNAS paper. Fig. 4.10 was prepared as explained by Dr Solomon in its caption, to convince the readers that[65]

> Amundsen's data [daily minimum temperatures] happen to lie on the warm edge of the range, while Scott's are generally near the mean, with the exception of one warm day. This difference in the luck of their circumstances, combined with Amundsen's earlier arrival, led to an overall difference of more than ten degrees in the average minimum temperatures experienced by the two groups at the Pole.

The analysis of Captain Amundsen's data as presented in Tab. 4.2 does not confirm Dr Solomon's difference of "ten degrees" of averaged minimum temperatures recorded by both parties. Dr Solomon's argument was that the minimum temperatures recorded by Captain Scott "are generally near the mean". However, the data on Fig. 4.10 are cut off by Dr Solomon on Jan. 23rd, exactly when recorded temperatures tend to be *well above* the long-term mean temperature. Looking farther beyond Jan. 23rd as depicted on another Dr Solomon figure, Fig. 4.2, one readily notices that the recorded minimum temperatures of Captain Scott's party are *well above* averaged temperatures recorded at the South Pole, at least until Captain Scott reached the Beardmore Glacier (38th day of the year). The open question remains: how do temperature gradients change over the Antarctic Plateau along the return route of Captain Scott's party? However, by showing only part of these data points as on Fig. 4.10, Dr Solomon falsely conveyed to the readers that Captain Amundsen was allegedly sledging in somehow favorable conditions, contrary to Captain Scott's party. By omitting data as depicted on Fig. 4.10 in comparison with Fig. 4.2, Dr Solomon manipulated the reader's understanding.

4.2.3. Dr Solomon Nullifies Captain Scott's Responsibility

The crux of Dr Solomon's fallacious reasoning is based on her argumentation of luck and typicality in relation to Captain Scott's *Terra Nova Expedition*. Both *luck* and *typicality* belong to a category of subjective assessment based on fuzzy definitions and concepts. Indeed, by arguing Captain Scott's luck, Dr Solomon nullifies his responsibility.

Chance is the handmaiden of probability, but "luck is probability taken personally. It is the excitement of bad math".[66] If everything is a matter of luck, humanity's reasoned actions are indeed meaningless. By introducing luck into the human description of reality, one nullifies the relationship between an event and its cause.

The investigative reader may recall Laplace's demon, whose deterministic actions I described at the beginning of Chapter 1. The cause and effect were deterministically

interconnected. Later in the same chapter, we learned that meteorological phenomena do not follow the Laplace's demon's path, but rather exhibit random and more precisely stochastic behavior.

"Until we can distinguish between an event that is truly random and an event that is the result of cause and effect, we will never know whether what we see is what we'll get, nor how we got what we got."[67] It is no wonder why Poincaré pointed out that "many persons find is quite natural to pray for rain or shine when they would think it ridiculous to pray for an eclipse".

Throughout the previous chapters, and until the end of this book, I am concerned with understanding probability theory and understanding the behavior of *random* events. The most common misunderstanding is thinking that a small sample of random events is representative of a large sample of these random events. A large sample of random events, like for example wind events, studied by me in relation to Dr Simpson's wind analysis – see section 3.1 – can serve as any example of the thinking by Dr Simpson that his *limited* data represents an underlining distribution of wind events. I have shown there that indeed it is not the case, and in the limit of a large sample of wind events, the underlying random distribution is very much different than that was "found" by Dr Simpson.

At the time of my analysis of Dr Simpson's wind events, I did not mention that his analysis was an example of what is known as the Gambler's Fallacy. In the case of my analysis as presented in Chapter 3, and not to fall into the presentism trap, I pointed out only what should have been known to Dr Simpson – that is, the law of large numbers.

Presently, there is a large body of research related to the Gambler's Fallacy, ranging from classical analysis to quantum physics counterparts.[68] Some 30 years ago, Tversky and Kahneman in an influential paper discussed the heuristics and biases that form the foundation of human probability reasoning and judgment. They pointed out that people have an erroneous intuition about the laws of chance.[69] Their thesis was not precise but it was simple: "People's intuitions about random sampling appear to satisfy the law of small numbers, which asserts that the law of large numbers applies to small numbers as well".[70] How, then, would the belief of a "hypothetical scientist who lives by the law of small numbers"[71] affect his statistical inference? It is known from the law of large numbers and the central limit theorem that a large sample is more likely than a small sample to approximate the true distribution of random events. This would be true, for example, for temperature fluctuations for a given time of the year. However, people display early (premature) confidence when streaks occur in random processes. The events of random streaks – a low probability event – are likely to happen over and over in time. However, statistical inference based on the occurrence of these small number of events is faulty, as it does not represent the distribution of the underlying population of events. More importantly, people tend to think of streaks as anomalies and suspect that a non-random process is interfering. The most famous and celebrated example of the fallacy based on the law of small numbers is the Gambler's Fallacy. It is a widely known logical fallacy. This fallacy consists of a bias in which individuals make an inference about future random streaks based on the outcome of previous streaks: the history of streaks *will affect* future streaks.[72]

Usually, the Gambler's fallacy is illustrated by an observer repeatedly flipping a (fair) coin and guessing the outcome (streak) before it lands.[73] If the observer be-

lieves in the Gambler's Fallacy, then after observing say four heads in a row, his subjective judgment of probability of flipping another head is less than 50%. He believes that a tail is due to, and it is certainly more probable to appear on the next toss than a head. One would say that the Gambler's Fallacy is that people think that the long-run frequency of any event *should also apply* even in a short run.

⋮

I will not examine in this subsection every instance of Dr Solomon's havoc with her judgments of luck and typicality. It would be tedious, but more importantly uninteresting to the reader. Instead, I will only expound, supported by example, on her creative skills in fallacious reasoning and straightforward lies.

Towards the end of her short Chapter 4 entitled *The Safety of Supplies*, Dr Solomon presents her assessment of the relationship between supplies, choice of *Terra Nova Expedition* landing site, and further sledging journeys. She starts with[74]

> The loss of coal in the gale and the tardy arrival in the Antarctic due to the extensive stretch of early-season pack ice they encountered were two elements in the tale that could scarcely have been anticipated [*sic*]. Because both coal and time were limited as they searched for the location to unload, the crew's haste set a domino effect into motion: because [*sic*] they opted to quickly base their camp at Cape Evans rather than at Cape Crozier or Hut Point, they were left a more difficult [*sic*] and longer route [*sic*] for the depot journey and similarly for the Pole in the coming year.

At the beginning of section 4.2, I already pointed out how Dr Solomon made an unsubstantiated claim that Captain Scott had an "anticipation" of more rapid crossing through pack-ice to Antarctica. But here she also adds a third factor, the limited time to search the site for the camp. Because of that, Dr Solomon tells the reader that "they opted to quickly base their camp at Cape Evans rather than at Cape Crozier or Hut Point," and because of that the "longer route" to the South Pole was "selected". Dr Solomon's suggestion is – and should have been noticed as – notoriously fallacious. Provided that one selects the coordinates of Corner Camp as a reference point (or One Ton Depôt), one can easily calculate the distance "as the skua flies" from Cape Crozier and Hut Point. The distances are d(CC-CC) = 46 geographical miles and d(HP-CC) = 10 geographical miles, respectively. Thus, establishing base camp at Cape Crozier would "move" Captain Scott's expedition from the Pole by an extra 36 miles. This distance would have proved fatal to at least the Second Return Party (Lt Evans, Lashly, and Crean).

Dr Solomon either did not read Captain Scott's diary or – and I tend to think this is correct – wanted to dramatize events facing Captain Scott. However, her descriptions are simple lies. Let us look into Captain Scott's journal. After approaching the Ross Island, the intention was to establish base camp at Cape Crozier. However, it was not a shortage of coal or time, but[75]

> … landing on the beach, on which the sea is now breaking incessantly; it would have taken weeks to land the ordinary stores and heaven only knows how we could have got the ponies and motor sledges ashore. Reluctantly and sadly we have had to abandon our cherished plan – it is a thousand pities.

> Every detail of the shore promised well for a wintering party. Comfortable quarters for the hut, ice for water, snow for the animals, good slopes for skiing, vast tracks of rock for walks. Proximity to the Barrier and to the rookeries of two types of penguins – easy ascent of Mount Terror – good ground for biological work – good peaks for observation of all sorts – fairly easy approach to the Southern Road, with no chance of being cut off – and so forth. It is a thousand pities to have to abandon such a spot.

The *Terra Nova* rounded Cape Bird and headed toward the old *Discovery Expedition* quarters at Hut Point. Captain Scott noted[76]

> We could have gone to either of the small islands, to the mainland, the Glacier Tongue, or pretty well anywhere except Hut Point. My main wish was to choose a place that would not be easily cut off from the Barrier, and my eye fell on a cape which we used to call the Skuary [Cape Evans] a little behind us.

Thus, the winter quarters of the *Terra Nova Expedition* were established at Cape Evans (the Skuary), not as Dr Solomon described, but due to the impossibility of landing at Cape Crozier and Hut Point. As if this was not enough, Dr Solomon summarized her discovery that "As he had on the *Discovery* expedition, Scott pushed his luck [*sic*] – this time with some disastrous results." These "disasters," in addition to the sinking of a motor sledge mentioned by Dr Solomon, were the deaths of a few animals (Lt Bowers' incident with ponies and one dog). As if this was not sufficient for the reader to feel pity with Captain Scott's bad luck, she goes on to formulate the prophecy that due to the above described unlucky events, as well as the poor resistance of the horses to Antarctica's weather, Captain Scott expected a late start, and thus Dr Solomon summarized[77]

> A late start also would mean a late finish – or no finish at all.

Of course, this is an unfounded conjecture, as there is no relationship between events "late start", "late finish" and "no finish at all." What is the late start? Who and what determines the start date? Captain Scott, Lt Shackleton, and Dr Wilson started from Hut Point on Nov. 2nd, 1902 and Lt Shackleton, Wild, Marshall, and Adams set out from Hut Point on Nov. 3rd, 1908. In the case of Lt Shackleton, on Jan. 9th, 1909, they reached their furthest point – latitude –88.3833, about 97 geographical miles from the South Pole – and returned to Hut Point on Feb. 28th, 1909.

We have seen in section 3.2 that Captain Amundsen's premature start was nearly fatal. But not only did the departure time matter.

It is fair to assume that from the beginning, Captain Scott was thinking about following Lt Shackleton's route to the South Pole. Because Captain Scott used the same transport methods, his opportunity lay in extending the chain of food supplies and increasing the sledging velocity. Captain Scott started from Hut Point on Nov. 3rd, 1911, exactly as Lt Shackleton did two years before, and reached the Pole on Jan. 17th, 1912. This was exactly when Lt Shackleton would have reached the Pole if he did not turn back 97 miles from the South Pole. Until this time, despite a number of setbacks, nothing heralded the events to come. Therefore, Dr Solomon's conjecture "A late start also would mean a late finish – or no finish at all." is simply hindsight.

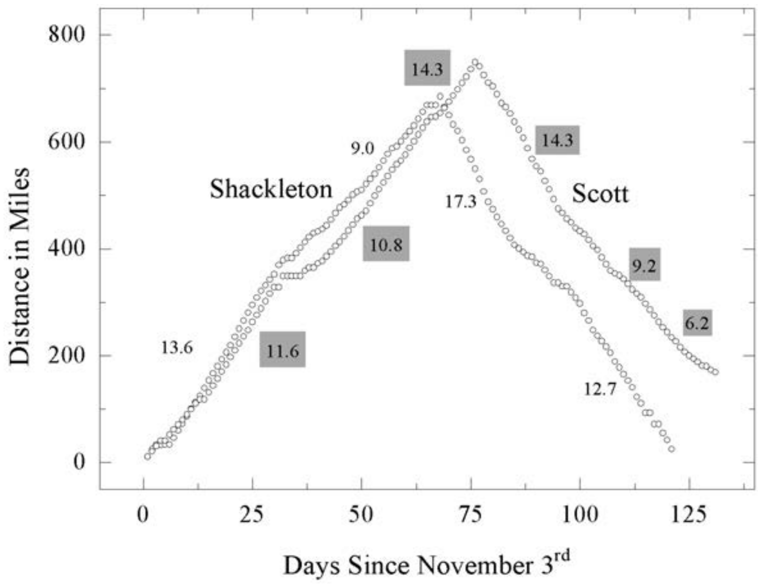


Figure 4.12. The plot of distances travelled since Nov. 3rd, 1908 by Lt Shackleton and by Captain Scott's party 1911/12. Approximate daily velocities are depicted on this figure in miles (geographical) per day. These velocities were obtained by linear least squares fit to distances at certain times of the travels, as depicted on the figure.

On Fig. 4.12, I depicted the respective distances and related sledging velocities of Lt Shackleton and Captain Scott's parties. This figure confirms the above-described conjuncture.

It is interesting to notice how Captain Scott was self-contradicting in relation to his plans for reaching the South Pole. From one side, he understood that[78]

> There is no doubt that Amundsen's plan is a very serious menace to ours. He has a shorter distance to the Pole by 60 miles – I never thought he could have got so many dogs safely to the ice. His plan for running them seems excellent. But above and beyond all he can start his journey early in the season an impossible condition with ponies [*sic*].

From the above comment, the investigative reader must notice that from the very start, there was not even the remote possibility, provided that Captain Amundsen and his team were not prevented from reaching the South Pole, that Captain Scott would arrive at the South Pole before Captain Amundsen. A rough comparison of Captain Scott and Captain Amundsen's distances travelled and respective velocities are depicted on Fig. 4.13. The superiority in efficiency and velocity of dog sledging over man-hauling was well known from Arctic exploration.[79]

From another side, Captain Scott maintained that[80]

> I cannot see that any plan would be altered if it were to do again, the margin for bad weather was ample [*sic*] according to all experience

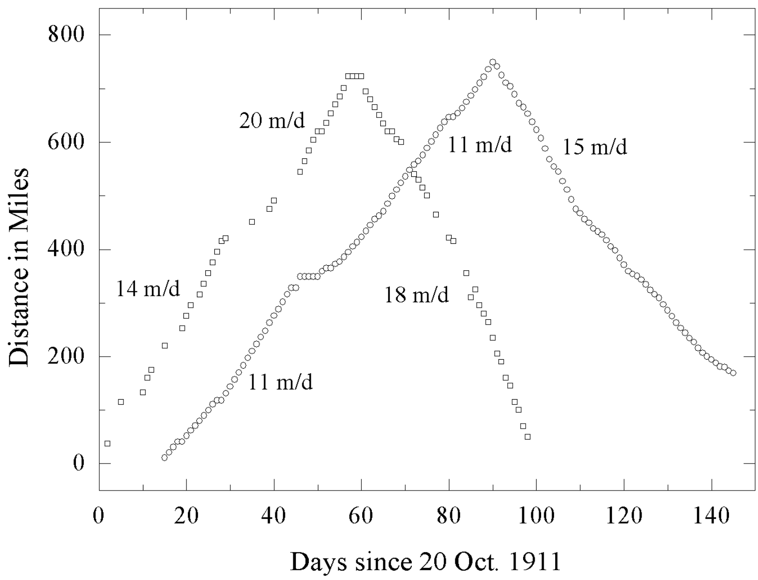


Figure 4.13. The plot of distances travelled since Oct. 20th, 1911 by Captain Amundsen and Captain Scott's parties. Approximate daily velocities are depicted on this figure in geographical miles per day. These velocities were obtained by a linear least squares fit to distances from their start point, as depicted on the figure.

Captain Scott presented a similar appraisal of his methods in his *Message to the Public*[81]

1. The loss of pony transport in March 1911 obliged me to start later than I had intended, and obliged the limits of stuff transported to be narrowed,
2. The weather throughout the outward journey, and especially the long gale in 83°S, stopped us.

However, his reference to "causes of the disaster" from the above discussion seem to be unjustified. From Fig. 4.4, one can notice that despite temporary setbacks, Captain Scott was able to maintain a steady sledging velocity of about *11 miles per day* during the outward journey, and even increase it to a fair 15 miles per day during the inward Plateau journey. Comparing Captain Amundsen's 14 miles with Captain Scott's 11 miles per day during the Ross Ice Shelf part of the journey, one has to remember that the energy expenditure of both parties was very much different. Nevertheless, the velocity of man-hauling during the 1911/12 South Pole journey was much greater than Captain Scott's dog sledging in 1902. See Figs. 4.13 and 4.14 for comparison.

To finish with the issue of luck in Dr Solomon's book, let me bring attention to the reader one of the most glaring errors in writing about the weather, Captain Scott's luck, and weather data fabrication. While describing the reports by Captain Scott at the foot of Beardmore Glacier of the four days' blizzard, Dec. 5th through 8th, 1911, Dr Solomon expounded[82]

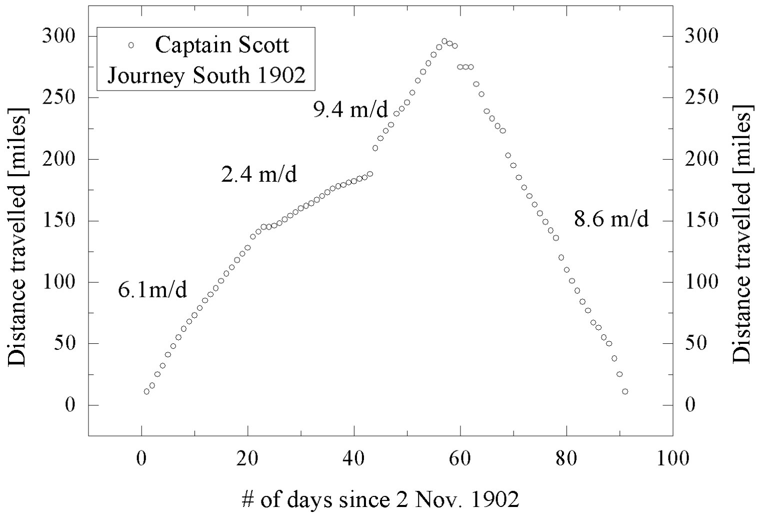


Figure 4.14. Dog sledging velocity by Captain Scott's party during their wandering over the Ross Ice Shelf in 1902/1903. All of the dogs in Captain Scott's party eventually died or were killed before the journey was over. The velocity is given in miles per day and was obtained by a linear least square fit to distance travelled from their starting point, as indicated on the figure.

> Although Scott had complained earlier in the journey about his luck compared to that of Shackleton, it was only with this storm that he and his party experienced truly unusual [*sic*] conditions. A wet, warm blizzard of such extended duration with winds in excess of fifty miles per hour [*sic*] has not yet been observed in eight years of December data at the nearby automated weather station at 83°8′S, 174°10′E, or in fourteen years of December data at the station at 79°54′S, 169°58′E (see map 2).

On Fig. 4.15, I depicted wind force in the Beaufort scale (0–12) reported by Captain Scott from midnight of Nov. 30$^{\text{th}}$, 1911. One can note that Dr Solomon's account "with winds in excess of fifty miles per hour" is a gross and unscientific exaggeration of wind velocity during the event. One would rather call it a gale event with winds of about forty miles per hour, the lower bound of gale velocities. However, this is not the biggest problem with Dr Solomon's account, as she continues[83]

> The longest and windiest storm recorded by modern instruments in this region of the Barrier occurred in December 1995. It lasted about two days and displayed peak winds of about forty miles per hour – comparable to storms experienced earlier by Shackleton and Scott.

The above, in conjunction with Dr Solomon's *Extreme Cold Snap* argument, shows how incredibly crooked her logic is. Let us recall Dr Solomon's fallacious argument that Captain Scott endured "colder than normal" temperatures because modern data from the Schwerdtfeger weather station shows in 1988 temperatures comparable to the ones in 1912. Thus, according to Dr Solomon, the occurrence of 1988 temperatures confirms the occurrence of the 1912 temperatures. If she followed this line of her previous reasoning, then since the biggest wind event from the modern wind data

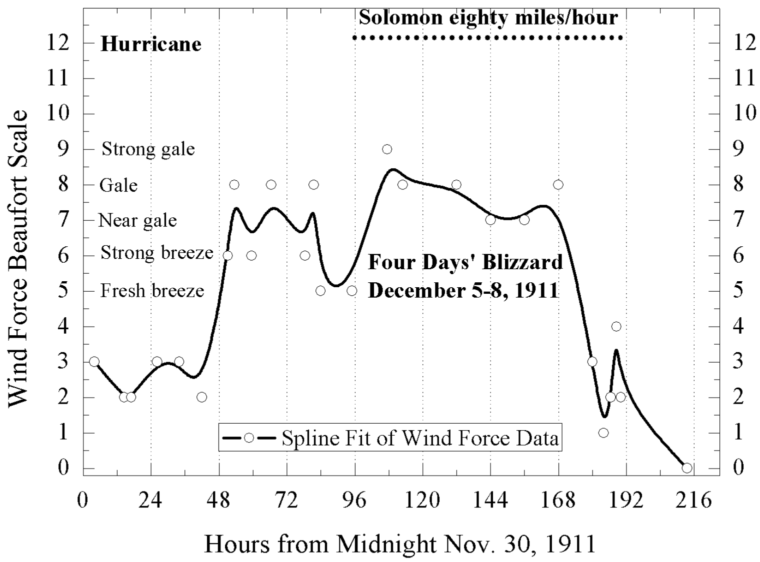


Figure 4.15. Wind force (○) in Beaufort scale (0–12) reported by Captain Scott[1] from midnight of Nov. 30th, 1911. Whenever the range of Beaufort scale was indicated in Simpson's Tab. 72, I have selected the highest force (Dec. 3rd, 4th, 5th, and 7th, 1911). Dr Solomon's "wind speed at up to eighty miles per hour" is also indicated in the upper region of this figure. See main text for discussion.

1 George C. Simpson, *Meteorology*, Vol. III, *Tables*, Harrison and Sons, Ltd., London, 1923, *cf.* p. 624 and 625.

did not match Captain Scott's blizzard (it is two times shorter), she *must* conclude that the four-days' blizzard in 1911 – brace yourselves – did not happen!

Dr Solomon, however, did not present such a conclusion, and the reader is left with a dilemma about her logic, or rather lack of it. It is a great scientific misconduct to manipulate data. Even greater misconduct is shown by Dr Solomon's purpose driven logic of argumentation. Using the same structure of comparison of modern and historic weather data, Dr Solomon formulates one conclusion or an opposite conclusion. This indeed shows that Dr Solomon is not using any scientific method in her work, but only a twisted goal driving her thinking (writing).

As if this was not enough, Dr Solomon the above-cited comments sums up with the following and terrifying recapitulation[84]

> But Scott and his men were tent bound [*sic*] while the blizzard dumped heavy snow for four full days, December 5–8, 1911, and they estimated the wind speed at up to eighty miles per hour.[72] [*sic*!] Scott and his men were the victims of bad luck [*sic*] in this exceptionally severe and prolonged storm, which must have been due to a tongue of warm, wet air from the ocean that pushed unusually far across the Barrier.[73] [*sic*]

I would say that Dr Solomon is at her best in falsifying Captain Scott's wind data. Her fabrication is twofold. First, she lies to the reader about "the wind speed at up to eighty miles per hour". The last wind category in the Beaufort scale is a hurricane,

with wind velocities equal or greater than 73 mph. It is not far from Dr Solomon's 80 mph. However, if the Captain Scott party was hit by such a hurricane in Dec. 5th through 8th, 1911, we would not hear from them again for many years. However, Dr Solomon is cunning in her description of the size of "bad luck," and she fraudulently supports her "eighty miles per hour" claim by citing reference 72 (Dr Simpson's volume III, pages 624–25), which is the exact source of the wind data used to draw my Fig. 4.15. From this figure, one can easily see how much of a fraudulent misrepresentation Dr Solomon's claim of "eighty miles per hour" winds is. The real bad luck is that the readers of Dr Solomon's book were persuaded by her codswallop expounds.

I did say above that Dr Solomon had developed in her book a purpose-driven logic and reasoning. She also fabricated weather data to support her fallacious interpretations. The other technique of changing history is Dr Solomon's selective and erroneous citations of various events, including weather related to the Captain Scott and Captain Amundsen expeditions. For example, in relation to the four-days blizzard of Dec. 5th through 8th, 1911, Dr Solomon presented counterfactual evidence that both explorers could endure adverse weather with equal endurance. Dr Solomon's logical construction of this is indeed shocking.

First, Dr Solomon commits hyperbole by formulating the meteorological thesis that[85]

> … the case of the storm of December 1911 reflects not the skills of the two leaders in dealing with the weather but rather their fortunes in geographic placement.

The reader must at once start to wonder what Captain Amundsen and his team had to do with the four days blizzard. Dr Solomon explains that at that time "Amundsen and his men were enjoying mild weather," and they even paused "in good weather for a photograph [see[86]] to mark the point where they passed Shackleton's southernmost point at 88°23′". Idyllic conditions indeed, but Dr Solomon continues her argument[87]

> If the same storm had occurred three weeks earlier, both [*sic*] teams would have been pinned down by it on the Barrier.[*sic*] Amundsen's faster pace did, however, reduce his time spent at the sea level on the Barrier and therefore his vulnerability to the possibility of such event.

Dr Solomon's "what if" approach, besides being started by Cherry-Garrard[88], leads her to a *cul-de-sac*. First, she makes an ambiguous meteorological assumption that the four days blizzard recorded by Captain Scott occurred at every point of the Barrier. This assumption, even without confirmation by modern data, is not true, because this blizzard was not simultaneously recorded at Cape Evans and Framheim. Framheim did record the wind for Dec. 5th and 6th, but the only time the wind reached gale force was Dec. 5th at 8 p.m. when the wind reached 60.2 feet per second (66.06 km/h). Framheim station was windless for most of the 7th and 8th of December 1911.[89] But even if a blizzard was recorded at Cape Evans, how can one *distinguish* that it was the same blizzard as described by Captain Scott?[90]

Because wind events in Antarctica are a self-organized criticality (see section 1.4), there is no relationship between the number of blizzard occurrences at the Ross Ice Shelf and the travelling time over it. Dr Solomon effectively suggests that while

driving California Interstate 5 Highway, one should speed up to not be caught by an earthquake. Does Dr Solomon postulate *ende aller streckenverbote* on California's autobahns? However, if one is afraid of earthquakes, one should not go to California[91]

> Seems it never rains in Southern California
> Seems I've often heard that kind of talk before
> It never rains in California
> But, girl, don't they warn ya
> It pours, man, it pours

Contrary to Dr Solomon's notion of Captain Amundsen's journey to the South Pole, his expedition *was* marked with many weather related concerns. Without venturing into the detailed analysis I just mentioned at the very start of the four days blizzard reported by Captain Scott, Captain Amundsen recorded in his diary "Tuesday 5 Dec. Have gone completely blind all day," and next "Wednesday 6 Dec. Have travelled absolutely blind all day".[92] The reader should not be confused, because they steered by compass. The navigation skill that Cherry-Garrard could not learn!

It was up to Captain Scott or Captain Amundsen to decide whether to stay or go. The decision was not simple, due to the many variables involved including contingency concerns, as Captain Amundsen while traversing the Nilsen Plateau (Dec. 3rd, ~85°43′S) plainly explained[93]

> We had only done 2 nautical miles. [*sic*] But we could have risked people, doggies and sledges in this filthy weather – and that is too costly for a miserable few nautical miles. Our tent is now pitched on bare ice – narrow crevasses everywhere. To reduce our loads, we left all our fur clothing [*sic*] at our previous camp this morning. However, we kept our anorak hoods, which we cut off the anoraks. –21°[C = –6°F] and storm from SE.

⋮

To nullify Captain Scott's responsibility as leader of *Terra Nova Expedition*, Dr Solomon attributed a share of luck to his many actions. In addition to that, and this time in relation to the weather conditions, Dr Solomon used in many instances another fuzzy and intuitive term – *typicality* or *typical*. The word typicality has two meanings/understandings. The first one is with reference to statistical physics,[94] and the second one is to prototype theory. Though the physical aspects of typicality are more interesting, I will stay here with the former, which is related to human intuition.

The words *typical*, *normal*, *average*, and sometimes *usual* are considered to be synonyms, and they are used to describe something of "having or showing the qualities associated with the members of a particular group or kind," or "being of the type that is encountered in the normal course of events ".[95] In subsection 4.1.1 of the present chapter, I have briefly expounded on the meaning of "normal weather". Keeping in mind the non-quibbles presented there, one has to observe that because Dr Solomon is not using any scientific method, she is resorting to vague terms like typical and usual, or to their antonyms atypical and unusual. See subsection 4.2.4.

I will bring to the reader's attention only two examples of this. The first one is directly related to Dr Solomon's already critically examined figure above, as depicted on Fig. 4.10. She fabricated this figure and temperature record to lament over Captain

Scott's miserable fate in comparison to Captain Amundsen's apparent sledging in high temperatures recorded in the vicinity of the South Pole. It appears that these false arguments seemed pleasurable to Dr Solomon, and she repeated them 75 pages later in chapter 13, titled *A Chillingly Unusual* [*sic*] *Month*, though in a slightly different context. In this chapter, Dr Solomon one more time wanted to show how Captain Scott was victimized by cold weather, and also wanted to show the accuracy of temperature measurements by his party. According to Dr Solomon[96]

> The average of the minimum daily values recorded at the Pole from January 13 to January 23 since 1986 are consistently quite near –23°F (–22.6 ± 3.7°F) [*sic*], as illustrated in figure 49 (page 215). Bowers's observation of an average minimum temperature of –23°F near the South Pole on the same days of the year more than a century before may stir the heart to sympathy for the bitter cold the polar party faced, and they surely bolster Simpson's view that his calibration was indeed accurate.[*sic*]

Yet again, Dr Solomon is appealing to average minimum temperatures (1986–1998) and compares them with Captain Scott's temporary 1912 record. On the basis of this comparison, Dr Solomon draws the conclusion about the precision and calibration of the thermometers of Captain Scott's party. Indeed, this is chillingly unusual logic and scientific methodology. First, Dr Solomon directly transfers her statistical codswallop from the PNAS paper, where she calculated the minimum daily temperatures –22.6 ± 3.7°F for the period Jan. 13th through Jan. 23rd "with an SD [standard deviation] of 3.7°F, which is in good quantitative agreement with Scott's 1912 data and thus further supports the measurement accuracy."[97]

Every science student at an introductory level is taught to understand that conventional statistics concerns random variables which are independent and identically distributed (i.i.d.), that each random variable has the same probability distribution as the others, and all are mutually independent. Besides objecting that Dr Solomon used a very limited number of data points (only 13 years), one must also notice that she did not prove that these *minimum daily temperatures* are indeed independent and identically distributed. She could have used so-called normality tests, as described by the Kolmogorov–Smirnov or Shapiro–Wilk tests. These tests would provide a measurement of the normality of random variables under consideration. However, provided that we are speaking about minimum temperatures, one immediately notices serious questions of how to analyze minimum temperature records: (1) day to day for the entire record, or (2) sequence of temperatures for each year and given period of the year, say Jan. 13th through Jan. 23th. In the former case, one is certain that the record of minimum temperatures is not i.i.d. The count of minimum temperatures occurrences for consecutive days in meteorological records, at least at the locations of Schwerdtfeger and Scott Base weather stations, is not independent and identically distributed. This simple fact is nicely illustrated by the occurrence number of minimum temperatures during the day, as depicted on Fig. 3.5. It also illustrates that *statistics of extreme values* do not follow a normal (Gaussian) probability distribution. On the following figure, Fig. 4.16, I depicted the results of a Kolmogorov–Smirnov test for minimum temperatures recorded in Europe for more than 50 years.

However, not only is a suitable analysis of distribution functions of minimum temperature missing in Dr Solomon's Fig. 4.10. In addition to that, and to incor-

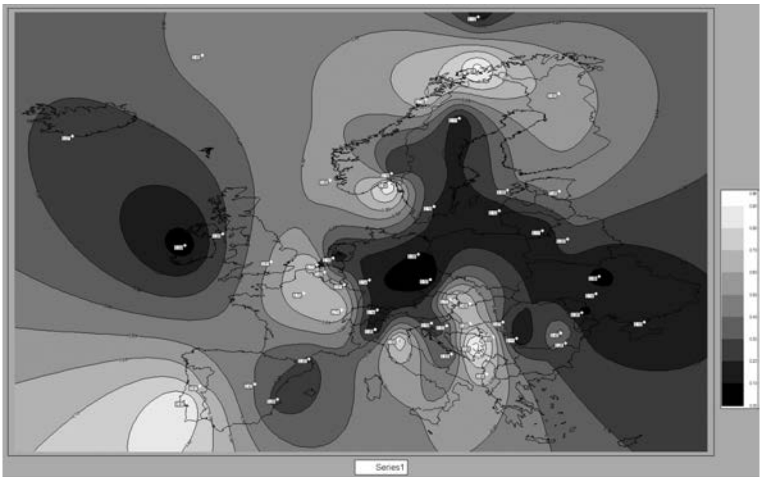


Figure 4.16. Normality tests are used to determine whether or not a data set is well-modeled by a normal distribution. The minimum temperature data was taken from the European Climate Assessment & Dataset and its website at http://eca.knmi.nl/dailydata/index.php. The test was made using the Kolmogorov–Smirnov method. An accuracy test was performed for weather stations across Western and Central Europe with temperature records of more than 50 years of data. The quality of this fit is indicated by shadows of gray overlaid over the European continent. The white areas are the areas where the distribution of minimum temperatures followed the standard normal. The darker areas on the map indicate where the accuracy of the fit is decreasing.

rect temperatures attributed to the record of Captain Amundsen and Captain Scott's parties (see Tab. 4.2), Dr Solomon also incorrectly depicts on this same figure the minimum temperatures recorded at the South Pole weather station. On Fig. 4.17, I depicted both the correct and Dr Solomon's temperature data. One can easily see that Dr Solomon's data is significantly off from the correct data.

A quick calculation gives a –20.5°F average minimum temperature at Amundsen-Scott South Pole for the period Jan. 13th through 23th, instead of –22.6°F as given by Dr Solomon, or –23.3 ± 0.6°F[98] as obtained by me from digitizing her figure in Fig. 4.10. By dragging temperature data in the considered period, Dr Solomon arrived at a specious argument that if Lt Bowers's temporary measurements (Dr Solomon's average of about –23°F) are "in good quantitative agreement" with long-term minimum temperature averages (Dr Solomon's average of about –23°F), then this indicates that "Simpson's view that his calibration [Captain Scott's calibration of thermometers] was indeed accurate."

It is indeed a "chillingly unusual" observation by Dr Solomon – something out of nothing. What an apparent coincidence of long-term averages with temporary temperature measurements has to do with thermometer calibration will remain Dr Solomon's inexplicable enigma. Or will she address this question, and tell us that the accurate difference between Captain Scott's data and the Amundsen-Scott South Pole data is –24.1°F (Scott)[99] – 20.5°F (South Pole) = 3.6°F and not nil? For more on that, see section 4.6, Dr Solomon at the Royal Society of Chemistry – Note Added in Proof.

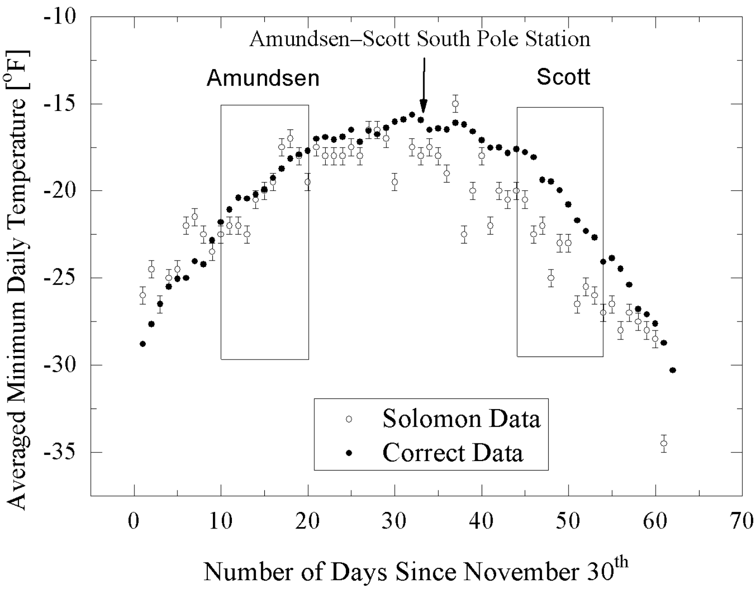


Figure 4.17. Averaged minimum daily near surface temperatures recorded at the Amundsen-Scott South Pole Station (●), and as reported by Dr Solomon (○) on her figure as depicted on Fig. 4.10. The error bars added to Dr Solomon's data are due to my digitization of her figure and are statistical errors of digitization. On the figure, I also indicated by two rectangles the time frames for when both parties were in the vicinity of the South Pole, as indicated on Fig. 4.10 and Tab. 4.1.

Towards the end of Chapter 13, with the telling title *A Chillingly Unusual* [*sic*] *Month*, Dr Solomon once again ponders on the essence of the matter of the Cold Snap of Feb. 27th through Mar. 19th, 1912. At this instance, she is again unable to produce a scientific explanation and argument, and once again she resorts to arguing about the "unlucky variability" that "struck Scott's party". Her argument is indeed erroneous. However, it is worthy of citation just to show Dr Solomon's specious logic, misperception and misinterpretation of meteorological data[100]

> The long-term climate of the Antarctic therefore shows high stability when averaged over a year, but Scott's fate reflects the fact that short-term weather varies in the Antarctic, just as it does worldwide. Temperatures sometimes dip far below the average or rise well above it for a month or so at the South Pole or at McMurdo. Just as an early-winter cold snap can strike London or Washington, so too can temperatures very in an individual period of several weeks in the Antarctic, and the modern record shows [*sic*] that such unlucky variability [*sic*] is what struck Scott's party on the barrier in March 1912.

Dr Solomon's argument is almost fine and satisfactory. The temperature variability counts, but only partly, and Dr Solomon manipulates the readers' attention by withholding a vital notion (at least since 1910 and by Vilhelm Bjerknes – see section 1.1) related to the analysis of meteorological phenomenon. Professor Bjerknes pointed out that comprehensive analysis of meteorological phenomenon is a dynamic process,

and must be analyzed by using the principle of simultaneity of spatiotemporally distributed variables. Temperature variability is a spatiotemporally distributed phenomenon. It means that temperature (as well as the remaining meteorological variables) is fluctuating simultaneously in space and time. It means that temperature correlations between London and Washington are small. However, the same correlations between say London and the rest of the UK are possibly higher.

On Feb. 2nd, 2012, *The Telegraph* – one of the leading British newspapers – under the heading *Snow to fall in London as bitterly cold weather grips Britain* reported[101]

> London is set to see its first significant snowfall today as the bitter cold snap continues to grip Britain. Daytime temperatures have plummeted four or five degrees lower than average for February which is traditionally the coldest month of the year.

The above newspaper note indeed describes "the bitter cold snap" as a real spatiotemporal disturbance. Is it possible, that as Dr Solomon suggested, this cold snap could be confined to the Greater London area? We know just by watching daily TV weather forecasts that the weather fronts move over large areas. Without the intention of going into a further and more detailed analysis, on Fig. 4.18 I depicted changes of daily minimum temperatures for three British metropolises reported by *The Telegraph* during the cold snap: London, Sheffield, and Liverpool. I selected Sheffield and Liverpool for comparison for a good reason. The distances between London and these metropolises are comparable to the distance between Cape Evans and One Ton Depôt or Schwerdtfeger weather station on the Barrier. From Fig. 4.18, one can notice that the above mentioned

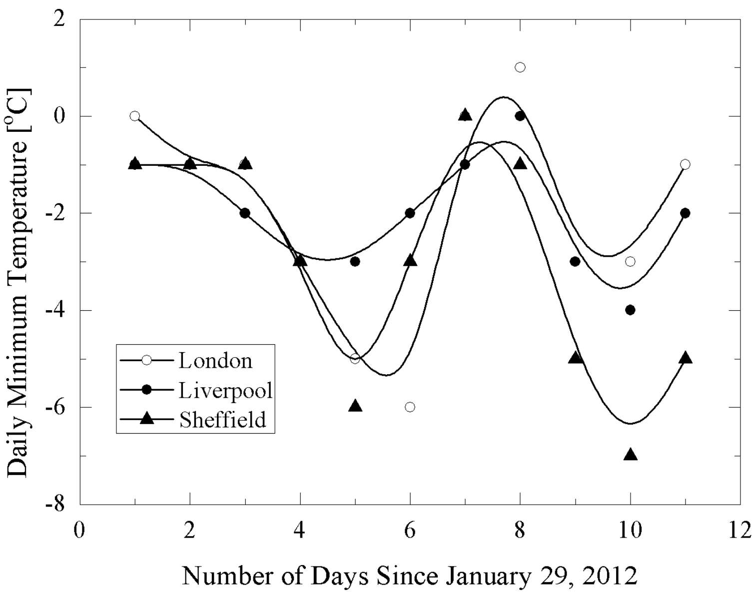


Figure 4.18. Daily minimum temperatures during the cold snap in January/February 2012. The data points are connected by a spline. The data were taken from http://www.wunderground.com/

cold snap was not isolated to the London metropolis, but was also observed in Sheffield and Liverpool. The changes of minimum temperature are tracking each other. Actually, the cold snap was detected throughout the whole British Isles and well beyond – in fact as far as 770 geographical miles away in my home.[102]

The above spatiotemporal dependence between daily minimum temperatures recorded at greatly separated locations in Britain is also observed at comparable distances on the Barrier in Antarctica (see Fig. 7.2). Therefore, Dr Solomon's obscure singling out that the cold snap struck *only* Captain Scott's party, and was not simultaneously recorded at Cape Evans or by the First Relief Party is fallacious thinking, and indeed it is the cherry picking fallacy.

4.2.4. Dr Solomon's Lack of Scientific Methods of Analysis

Throughout her book, as well as in the PNAS article, Dr Solomon used words that sounded like the elements of a scientific methodology, but scientific language does not make a science[103]

> Because science has such a powerful mystique in our society, those who wish to gain respectability but do not have evidence try to do an end run around the missing evidence by looking and sounding "scientific".

However, as I have shown in the preceding subsections of the current chapter, Dr Solomon not only presented unsound results, but she also fabricated data to fit her counterfactual accounts.

A scientist is an individual who uses the scientific method. Much effort has been devoted to describing and analyzing the true meaning of the scientific method. The amount of elementary scientific scrutiny not addressed in Dr Solomon's book amounts to "The Coldest Fabrication". It includes the following:

1. Lack of analysis of probability distribution functions of minimum temperature records,
2. Lack of appropriate method of averaging the results from real observed probability distribution functions,
3. Lack of statistical significance analysis of temperature records,
4. Lack of statistical hypothesis testing of her thesis,
5. Lack of statistical error analysis,
6. Tantamount of weather and climate,
7. Her belief in the law of small numbers,
8. Her fallacious reasoning: Gambler's Fallacy, Cherry Picking, and Affirmation of the Consequent Fallacy,
9. Fabrication of meteorological data to prove her case,
10. Subjective assessment of luck and typicality,
11. Biased perception of Captain Scott as a scientist.

Indeed, the above list is as impressive and worrying, as it is unbelievable. I am not speaking here about differences in interpretations of specific issues. I am speaking about data fabrication, the most serious misconduct of the scientist. The facts speak for themselves.

To illustrate not only Dr Solomon's lack of scientific method in analyses but also her mysterious and selective argumentation, let me briefly look at her bogus "explanation" of low temperatures reported by Lt Bowers and Captain Scott. She starts the argument by describing how "Simpson dug deeper, trying to find the reason for the unusual weather".[104] Apparently, part of Dr Simpson's work was done in conjunction with Dr Gilbert T. Walker from the Indian Meteorological Department, who presented an initial description of the Southern Oscillation, later known under the name of the *El Niño* Southern Oscillation (ENSO). *El Niño* is a quasi-periodic erratic climate pattern. To show that there is a link between her work and *El Niño*, Dr Solomon cites one piece of research where apparently by using statistical methods it was shown that[105]

> A statistical study of temperatures at Antarctic stations has indeed suggested a modulation on an ENSO-like time scale of about four years, with minimum [lowest] Antarctic surface temperatures tending to occur on the Barrier near [*sic*] the *El Niño* phase of the ENSO cycle.

From the above citation, and because 1911–1912 was the so-called *El Niño* year, Dr Solomon was ready to draw this general and sweeping conclusion[106]

> … it is increasingly clear that both the Antarctic continental weather and key processes in its oceans do fluctuate in roughly [*sic*] a four-year cycle, and Scott's party struck [*sic*] these variable rhythms in their unfortunate cadence.

Indeed, it is a daunting deduction that *El Niño* singled out and ruthlessly tracked the Captain Scott party. At the same time, *El Niño* did not show its powers in the Cape Evans, Hut Point, *Terra Nova*, Cherry-Garrard, Dr Atkinson, and Captain Amundsen records. Indeed, the decrees of God are inscrutable.

Since 1902–1903 was also an *El Niño* year, why was Captain Scott's party during the *Discovery Expedition* not struck by the "unfortunate cadence"?

Finally, one would again wonder how selective and counterfactual the "*El Niño* reasoning" was presented by Dr Solomon. While suggesting to the readers that "Scott's party [was] struck" by the 1912 *El Niño*, Dr Solomon compares Captain Scott's temperature data with similar data for the year 1988 (see subsection 4.1.1). However, the year 1988 *was not an El Niño year*![107] Moreover, the year 2004, the second coldest year on record at the Schwerdtfeger station location, was also not an *El Niño* year.

4.3. Dr Solomon's Hoax Epiphany – Something out of Nothing

> *Either something is authentic or it is unauthentic, it is either false or true, make-believe or spontaneous life; yet here we are faced with a prevaricated truth and an authentic fake, hence a thing that is at once the truth and a lie.*
>
> Stanisław Lem[108]

Despite the errors described above – data dragging, data fabrication and counterfactual reasoning – I have to admit that it is not easy to find and figure out what Dr Solomon's actual thesis was. While reading her article in PNAS, or using her book

as an exploratory reader, I tried in vain to find a clearly defined thesis by her. Does this suggest a hidden meaning? I have been wondering about this question for a long time. My academic experience was telling me that if the thesis of scholarly work cannot be clearly defined, then there is no thesis present. Superficially, Dr Solomon appears to be straightforward about her result

> It took about 15 years of research. First I read the diaries and everything else I could find, and then I collected the expedition's data and compared it with modern data. Then I had one of those wonderful moments of scientific epiphany when you say: "Oh my gosh, I understand this now." No one could have predicted the persistent cold weather that Scott faced. In 17 years of direct data from the area where he died, there's only been one year like that. George Simpson, Scott's meteorologist, was convinced that the weather was highly unusual, but he couldn't prove it and I could. That's when I know I had to write this book.

But, if one reads thoroughly Dr Solomon's above account of her epiphany (already cited before), one finds its stunning ambiguity. What was Dr Solomon's revelation anyway? Was it that she figured that "No one could have predicted the persistent cold weather that Scott faced"? Or that Dr Simpson "was convinced that the weather was highly unusual, but he couldn't prove it and I could"? For anyone, including atmospheric physicists, such a bold statement is indeed gibberish. How can anyone prove something like "highly unusual weather"? Is Dr Solomon's hypothesis of "highly unusual weather" a testable statement? If so, then what was Dr Solomon's scientific method for testing her hypothesis of "highly unusual weather," "colder than normal," or "very much colder than normal"?

Dr Solomon's "highly unusual weather" is only a part of her hypothesis. Her whole notion is that[109]

> The simple circumstance of normal [*sic*] March weather on the Barrier would very likely have produced a different outcome. If the polar party had not met the severe cold that Simpson credited with their downfall, it seems likely that they would have achieved distances of about fifteen miles per day [*sic*] on the Barrier, just as they had been managing until that point [*sic*].

Besides Dr Solomon's lie about Captain Scott's sledging velocity of "fifteen miles per day on the Barrier" – see Fig. 2.3 and 4.12 – Dr Solomon's above writings can be made more transparent if transformed to a syllogism

Argument 2

If the highly unusual (cold) weather did not strike Captain Scott's party in late February and March 1912, then the party would survive.

The structure of Argument 2 can be further simplified and assume the form

Argument 2

If the 1912 weather strike struck Scott's party, then the party perished.

Thus, we are ready now to look at the logical structure of Dr Solomon's reasoning. For this purpose, one has to be able to distinguish between *propositional logic* in which formal language is analyzed as representing logical propositions and common linguistic fallacies. In here, I take pleasure to mention my (not only mine, presumably) misery of attending yearly lectures (in 1975 at Nicolaus Copernicus University) given by Professor Leon Gumański.[110] The title of his course was: *Introduction to Contemporary Logic*. As each of us was intended to be the next Copernicus, our study program was set at an unreasonably high level. We were the subject of an educational experiment. I guess that since that time, my sensitivity to propositional logic, despite many lapses, remains high.

By looking at the logical structure of sentences having the structure "*If … then …*" one has to be able to distinguish and identify it in terms of the *original argument* and *argument form*. Consider an example:

- *Original Argument* is a statement

  If I am at the South Pole, then I am in Antarctica.
  I am at the South Pole.
  Therefore, I am in Antarctica.

- and its *Argument Form* is

  If $\mathcal{P}$, then $\mathcal{Q}$.
  $\mathcal{P}$.
  Therefore, $\mathcal{Q}$.

In Tab. 4.3, I summarized and illustrated the principal difference between the logically sound *modus ponens* argument, and the logical fallacy of affirming the consequent for a general case and for Dr Solomon's argument. First of all, one should carefully look and compare the fundamental differences between *modus ponens* and affirming the consequent arguments. The comparison of original arguments for the South Pole location is the most illustrative for understanding the difference between the logical argument and the fallacious argument of the "*If … then …*" type.

The same remark applies to Dr Solomon's argument in which instead of logical reasoning (*modus ponens*), she fallaciously argued by affirming the consequent! Therefore, her argument is invalid, and that is fundamentally evident from Tab. 4.3.

Investigative readers may already understand that Dr Solomon's argument (Tab. 4.3) is unacceptable, but the same observers may rightly be confused by the fact that in a logically acceptable argument I have used "1912 strike" as its part. It may imply that "1912 strike" is the sound part of the argument. However, this is not the case. One can recall here that in the above analysis I have *assumed* that the "1912 strike" occurred.

However, as we know from subsection 4.1.1, Dr Solomon's Argument 1 relating to strike 1912 is fallacious. Thus, Dr Solomon's fallacious

Table 4.3. Comparison of logical *Modus Ponens* argument and the fallacy of Affirming the Consequent.

***Modus Ponens* Argument**	**Affirming the Consequent Fallacy**
<u>Argument Form</u> If $\mathcal{P}$, then $\mathcal{Q}$. $\mathcal{P}$. Therefore, $\mathcal{Q}$.	<u>Argument Form</u> If $\mathcal{P}$, then $\mathcal{Q}$. $\mathcal{Q}$. Therefore, $\mathcal{P}$.
<u>Original Argument</u> If I am at the South Pole, then I am in Antarctica. I am at the South Pole. Therefore, I am in Antarctica.	<u>Original Argument</u> If I am at the South Pole, then I am in Antarctica. I am in Antarctica. Therefore, I am at the South Pole.
<u>*Modus Ponens* Argument</u> If the 1912 strike struck Scott's party, then the party perished. The 1912 strike struck Scott's party. Therefore, the party perished.	<u>Dr Solomon – Affirming the Consequent Fallacy</u> If the 1912 strike struck Scott's party, then the party perished. The party perished. Therefore, the party was struck by the 1912 strike.

Argument 1

> If the 1912 strike is true, then the 1988 strike is true. The 1988 strike is true. Therefore, the 1912 strike is true.

combined with Dr Solomon's fallacious

Argument 2

> If the 1912 strike struck Scott's party, then the party perished.

form a logical inconsistency.

4.4. Biased Perception of Captain Scott as a Scientist

Captain Robert Falcon Scott was a Royal Navy officer and explorer who led two expeditions to Antarctica. Since early childhood, Captain Scott followed the family tradition of serving in the armed forces. At age 13 (1881), he passed his exams and entered his naval career as a cadet. Until June 11th, 1899 when he agreed to lead an Antarctic expedition, he was educated by the Royal Navy training system. At the time of his appointment as the leader of *Discovery Expedition*, the then Lieutenant

Scott was aged 31. I am not aware of RN training methods. However, as a lieutenant in the Polish Marines where I was obligatorily conscripted for 1 year's training after finishing university, I have a pretty good feeling about "according to the book" training methods. These military methods are to teach one how to launch a torpedo rather than wonder about the cavitation of its propeller.

For that general reason, I believe that it is fair to say that Captain Scott was a trained RN officer. However, Dr Solomon in her book makes a considerable effort to convey to the reader that Captain Scott was a scientist. It is indeed a hasty assessment. It is similar to arguing that otherwise interesting magazines like *New Scientist* and/or *Scientific American* are scientific journals. Dr Solomon is thriving on the possible confusion between a benign scientist and a science enthusiast. I am a theoretical physicist, and I consider myself to be a scientist who contributed scientific results in a narrow field of excitonic energy transfer (migration) in molecular systems. However, as a benign a scientist in this narrow field, I am not a scientist in say high energy physics. Surely I have many interests within physics and other disciplines. However, these interests do not make me a scientist in these disciplines. I guess one can find many examples of such relationships. At this moment, I recall the case of Richard Feynman, an American theoretical physicist who contributed greatly in quantum electrodynamics. Dr Feynman is also known for his interests in "every day" science and a keen popularizer of physics. Because of these general interests, Dr Feynman figured out that the shuttle's O-rings not properly sealing in the Space Shuttle Challenger were the ultimate cause of the 1986 disaster. If Dr Feynman throughout his life had only made this "discovery," no one would venture to call him a scientist. He was a scientist because of his work in electrodynamics and path integral formulation of quantum mechanics.

A scientist is an individual who uses the scientific method. The usage of the scientific method ensures that scientific peers may follow and repeat the original research. Scientific contribution, and thus science, must be verifiable. One mere observation of the phenomenon and even its factual description does not make one a scientist. After all, we all see the Sun every day, but it does not make us solar physicists or more generally astronomers. Even Heinrich Schwabe, who for 17 years – from 1826 through to 1843 – was observing sunspots, can hardly be considered a scientist for this alone. In addition to his long-term observations, he analyzed sunspot frequency (variation in the number of sunspots) and noticed their certain periodicity. The combined tasks of measurement, analysis, and conclusions made Heinrich Schwabe a scientist, even if he did not have a formal scientific education.

From the above generally acceptable point of view of calling someone a scientist, Dr Solomon's notion that Captain Scott was a scientist sounds like specious rubbish. For Dr Solomon, it is not only a question of whether or not Captain Scott was a scientist. It is a question of Captain Scott's responsibility as the leader of the *Discovery Expedition* and especially the *Terra Nova Expedition*. We have already seen in subsection 4.2.3 of the current chapter how Dr Solomon attempted to nullify Captain Scott's responsibility by accounting for his last expedition using the manipulated, fuzzy, and misleading terms of typicality and luck. For further removal of Captain Scott's obvious leadership responsibility, Dr Solomon produced two counterfactuals[111]

> Scott confessed more than a decade before he died in the Antarctic that he had no predilections for polar exploration. But he did have a predilec-

> tion for science, and he approached the myriad challenges of polar travel as many a scientist would: by estimating requirements based upon observations and experience rather than by guessing what might be needed in his worst imagination.

and[112]

> Perhaps those very scientific leanings lie at the root of Scott's tendency to choose paths that ought to work, instead of these with large enough margins for error to ensure success under the worst cases rather than the likely one. Scott persistently faltered by cutting things too fine.

In plain English, according to Dr Solomon, if Captain Scott was not a "scientist" and/or did not use his "scientific leanings," he would guess or use a large portion of what "might be needed in his worst imagination". Furthermore, because Captain Scott was a scientist, he "persistently faltered" in his actions and judgments "by cutting things too fine".

From here, Dr Solomon has just only one more step to say that if and only if 1912 was a "more normal year,"[113] "normal March,"[114] or "more typical year,"[115] instead of an abnormal "very much colder than normal"[116] year, then "their fates [Captain Scott's party] would have been different".[117]

The bloody science and the trust in science and its methods finished Captain Scott and his companions. Thus according to Dr Solomon, if Captain Scott went to the South Pole blindfolded, he most certainly, like Captain Amundsen, would return from the journey. It reminds me of St. Augustine's (354–430) adage[118] which I used in the Prolegomenon of this book

> The good Christian should beware of mathematicians, and all those who make empty prophecies. The danger already exits that the mathematicians have made a covenant with the devil to darken the spirit and to confine man in the bonds of Hell.

However, Dr Solomon is not St. Augustine, and she boldly continues her argument by reconfirming the pernicious impact of usage of scientific methods by Captain Scott[119]

> Amundsen chose a solution to the problem with large margin of safety, while Scott selected a scientific [*sic*] one that ought [*sic*] to have worked but did not [*sic*].

Surely, you are joking Dr Solomon! It can't be that because of Captain Scott's alleged "scientific pursuits,"[120] "Scott and his men endured a highly unusual twist of fate".[121] To be sure, Dr Solomon does not present her analysis of Captain Scott's journey to the South Pole in terms of the relationship of "margin" analysis and the weather. Which Captain Scott's margins were too narrow due to his "scientific leanings" and "cutting things too fine"? Dr Solomon gives a rather precise and surprising answer to this question[122]

> He was an honest man who wrote frankly of his mistakes … As he died, he eloquently described a failed experiment with the frustration of a scientist [*sic*] who discovers the source of his miscalculations [*sic*] too late.

Of course, the description to which Dr Solomon is referring is Captain Scott's *Message to the Public* (see also section 12.2). I have already discussed a number of times Captain Scott's summary of his journey to the South Pole, and indeed one can hardly find anything which calls for saying he did a scientific margin analysis. The very preamble of the *Message* tells the truth

> The causes of the disaster are not due to faulty organisation, but to misfortune in all risks which had to be undertaken.

Yet again, Dr Solomon misinterprets Captain Scott's own statements by saying that he "miscalculated" something. The South Pole journey, according to Captain Scott, did not have "faulty organization". Only the risks or rather to say the sum of "all risks" was responsible for the disaster.

Within the notion of all risks, one can artificially distinguish between controllable (calculated) risks and uncontrollable risks. The uncontrollable risks are the hazards chiefly related to the weather. The rest of the risks were more or less controllable and thus one may call them calculated risks: human and animal endurance, food, clothing, mode and velocity of sledging, *etc*.

What was "the source of his miscalculations," according to Dr Solomon, if Captain Scott told us that organization of the journey was satisfactory? Is Dr Solomon saying that Captain Scott intentionally misled the readers of his *Message to the Public*? It is customary in her book that she is not supporting her thesis by detailed analysis or citation, and the reader is left in limbo. The only possible Captain Scott miscalculation she discusses is in relation to the "food margin". Dr Solomon ends her cursory analysis and chapter titled *In Search of Explanations* with a counterfactual question[123]

> … how could the polar party composed of the strongest men have failed, particularly when so much food and fresh meat [*sic*] had been carefully left for them?

It is utterly idiosyncratic nonsense. But there is a camouflaged purpose to boost Dr Solomon's discovery explained in her following Chapter 13, with the telling title: *A Chillingly Unusual Month*. From the above conclusion, it appears that there was nothing miscalculated by Captain Scott, and plenty of food including "fresh meat" waiting for the Captain Scott party at One Ton Depôt and the remaining Barrier depôts. But only one issue remained, as described by Captain Scott – the "scientist [*sic*] who discovers the source of his miscalculations [*sic*] too late."[124]

> It is clear that these circumstances [the Cold Snap] come on very suddenly, and our wreck is certainly due to this sudden advent of severe weather, which does not seem to have any satisfactory cause.

Now we see that "Scott the scientist" and the scientist Dr Simpson could not "have predicted the persistent cold weather that Scott faced". Besides, Dr Simpson "couldn't prove it" but the scientist Dr Solomon, enlightened by "scientific epiphany" could, and "that's when I [Solomon] knew I had to write this book". The results are described by me in the current chapter.

Before moving on, let me point out that the investigative reader may find in Dr Solomon's book more instances where she is referring to Captain Scott as a scholar

and/or scientist. I will not mention these instances, but I will briefly point out a few out of the many instances where Dr Solomon speaks about Captain Scott as a person not scientifically inclined.

In subsection 4.2.1, I pointed out a number (out of many) instances where Captain Scott unscientifically referred to the weather as climate. Captain Scott confused short with long-term time series, or small with large samples. A very similar unscientific approach, without realizing its true nature, is presented by Dr Solomon in regard to Captain Scott's choice of transportation mode in Antarctica[125]

> As he had the motor sledges, Scott the scientist also tested [*sic*] the use of dogs. The animals had proven to be of limited value on the *Discovery* expedition, at least in part because of spoiled dog food [*sic*]. Based upon his frustration with the canines on that [*sic*] trek, Scott had little hope that they would be useful for more than shorter journeys as far as the edge [*sic*] of the Barrier in 1911–12.

Dr Solomon's above expounding of the relationship between "Scott the scientist" and the mode of sledging during in the *Terra Nova Expedition* is *contradictio in adjecto* of Dr Solomon's turgid expounds. It also shows that Dr Solomon's "Scott the scientist" is an oxymoron.

The first line in the above expound is a great harbinger of the test, a part of the scientific method applied by Captain Scott. The *test* is a *procedure* of submitting a statement to such conditions or operations as will lead to its proof or disproof, or to its acceptance or rejection.[126] In vain, one would look into Captain Scott's accounts and materials. However, no need for that. Dr Solomon presents Captain Scott's procedure of draught dog usefulness testing. Captain Scott's tests were based, according to Dr Solomon, on "his frustration with the canines on that [Southern Journey 1902/03] trek". To put it straight, the notion of testing was alien to Captain Scott. This is very distinctive to the military education system and military men.

Captain Scott, before his *Discovery Expedition*, was essentially told by Sir Clements Markham and indirectly by Sir Francis L. McClintock to use dogs as draught animals. However, as I have shown in a detailed way in Table 10.6, section 10.3, it was Sir Francis' *ill advice* in regard to sledging-dog food rations that changed the history of Antarctic exploration. The dog food was not spoiled or tainted by a mysterious species of scurvy. The dogs, on *half rations* as recommended by Sir Francis, literally starved or were fodder for the remaining dogs. Captain Scott may have been "frustrated," but if he was a scientist or had a scientific inclination, he would have (before and/or afterwards) tested the issue of his dogs' poor performance during the *Southern Journey* in 1902/03. None of that occurred.

It would be unfair to Captain Scott to say that he did not test his equipment, methods, or personnel. He tested with varying scrutiny his motor sledges or crampons, for example. However, he did not test, investigate, and re-test what was most crucial in his South Pole journey – that is, people and animal performance. Provided that Captain Scott had ample time before embarking on the South Pole trip, his simple confidence that he could sort out the velocities on the One Ton Depôt journey in early 1911 is telling. But only for us, and not for Dr Solomon[127]

> Shackleton had gotten to within one hundred miles of the Pole using ponies and men, so Scott reasoned that success could be achieved with just a few more animals and men.

Dr Solomon's observation shows how unscientific and un-analytical Captain Scott was. It also shows that Dr Solomon is unable to grasp the dangers of such thinking. In both cases of Sir Francis' advice and Lt Shackleton's performance, Captain Scott accepted them without scrutiny, examination, or field tests. If transportation in Antarctica or otherwise was a linear matter, then Dr Solomon's thinking as presented above would be right. However, history – for example, Napoleon's invasion of Russia in 1812 – has explicitly proved that related matters of group size and transportation logistics are not linear issues and/or processes.

Yet again, Captain Scott and Dr Solomon fall into the trap of the law of small numbers. Indeed very small – the law of singleton, {1}. There is no scientific rationale to make a decision of a multi-variable question based on one occurrence. By looking at the group's travelling performance, it is apparent that it will travel with the velocity of the slowest member (human or animal), and by increasing the numbers there is no evidence of increased performance. Conversely, in a case of a small company, a loss of one of its members may seriously impede the whole group.

Without addressing the above questions and issues, both Captain Scott and Dr Solomon are neither scientific nor rational. We will never know for sure; however, what if Lt Shackleton's *Farthest South* latitude of 88°23′S, combined with a safe return, was the maximum distance that could be covered with the methods of human and animal performance? After all, the Second Return Party also barely made it home from latitude 87°19′S.

While falsely worshipping at the altar of science, Dr Solomon neglects the most simple truth, that complexity of issues related to polar travelling is enormous, and the power of science is very limited in its predictive powers. Therefore, a simple use of science, its methods, and explicit knowledge may terribly fail if applied to complex systems, such as weather prediction, the efficiency of transportation, *etc*. In such a case, and in addressing complex issues, one could resort to tacit knowledge as a guide for actions in complex situations.

A number of people, including Dr Solomon, have sought to portray Captain Scott as a scientist. However, their willingness to change the perspective of how Captain Scott is perceived by the public is not paying off in genuine arguments. All these claims are unsubstantiated and raise more questions than answers. On a number of occasions, the attempts get ridiculously funny when one is trying to portray the scientific pursuits of Captain Scott and his expedition members. Of these, the most ridiculous attempts are

> "They were hauling 35 lbs of rocks *each* [emphasis mine] on the way back," Lt Cdr [Paul] Hart says. "For Scott, the expedition was first and foremost about science."[128]

> Famously beaten to the Pole by a Norwegian party led by Roald Amundsen, Scott's expedition party *also took ice and rock samples before beginning their 810-mile return journey, pulling the ice cores* [*sic*] *behind them across the frozen wastes of the Antarctic*.[129] [emhpasis mine]

We will meet Lt Cdr Hart again in section 9.3. And here on Fig. 4.19 is one more example out of many, this time from the Scott Polar Research Institute. The knowledgeable reader gets immediately confused by this image caption, as the occultation of Jupiter is indeed a very rare event. Occultation refers "to any situation wherein an object in the foreground blocks from view (occults) an object in the background."[130] Therefore, "occultation of Jupiter" means that Jupiter occults a celestial object in the background. Occultation by planets is a very rare event.[131] "The last such event occurred on Jan. 3rd, 1818 and will next occur on Nov. 22nd, 2065, in both cases involving the same two planets – Venus and Jupiter."[132] As a result, one wonders what Lt Evans was observing on June 8th, 1911. With more careful scrutiny, one finds that from midnight of June 7th/8th, 1911 until say 8 am. of June 8th, the *Moon was occulting Jupiter*. The outsider may marvel: what is the point about which celestial body is occulting the other? However, the point is fundamental and explained by the definition of occultation, which today and one hundred years ago was the same.

Figure 4.19. At the Scott Polar Research Institute –SPRI Prints catalogue[1] the following description it attached to this image: Description. Lieut. Evans observing an occultation of Jupiter [*sic*]. June 8th 1911 [Original caption]. Date: 6.1911. Evans, wearing a balaclava and greatcoat, looks through a telescope resting on a tripod. He sits on a box in front of a semi-circular wall made of wooden boxes. Hut is behind the wall. From the British Antarctic Expedition 1910–13 (Ponting Collection). Photograph by Herbert G. Ponting, Alexander Turnbull Library, Wellington, New Zealand.

1 Also available at http://www.spriprints.com/image/362581/lieut-evans-observing-an-occulation-of-jupiter-june-8th-1911

4.5. Temperature Mania

While equipped with the above analysis of Dr Solomon's and partly Dr Stearns' examination of Captain Scott's weather record, let me briefly look at the aftermath of their publications. I did not research this issue in detail. However, it seems to me that Dr Solomon's book, *The Coldest March*, received remarkable recognition in comparison to other books. The reviews and examinations of Dr Solomon's work can be divided into three categories:

- Journalists,
- Polar Journalists/Authors,
- Authors/Historians.

Sure enough, these reviews and comments constitute many insights. However, nearly all of them are rather insignificant and do not contribute to the insightful examination of Dr Solomon's writings. It would be too tedious and not constructive to scrutinize here every piece of these reviews, as they vary in scope. The very purpose of book reviewing is to present comments and book evaluation in regard to specific topics under consideration.

Let me look in some detail only at reviews written for the distinguished journal *Nature* by Dr Cornelia Lüdecke, a German polar historian, and by Dr Beau Riffenburgh who is an Institute Associate of the Scott Polar Research Institute, and the author of three books about polar exploration.

Dr Lüdecke's review was titled *Tragic Outcome of Extreme Conditions*.[133] Right from the start, she is presenting her assessment of Dr Solomon's thesis

> Susan Solomon, an experienced polar researcher [*sic*] and leader of the American National Ozone Expedition, shines new light on Scott's tragic leadership error in not being able to predict the unexpected [*sic*] – unlike Roald Amundsen, who won the race.

To my knowledge obtained from reading Dr Solomon, she never claimed to be a "polar researcher," but instead she claimed in her CV, in the section Honors and Awards to receive The Nobel Peace Prize in 2007.[134] From Dr Lüdecke's above line, it appears that the wizard Captain Amundsen predicted the unexpected – contrary to Captain Scott, who as a lesser wizard and apparently not a graduate of Hogwarts School of Witchcraft and Wizardry, could not predict the unexpected. Without even the naming of the unexpected, it is indeed difficult to predict it. Is not "predicting the unexpected" a tautology? Dr Lüdecke foists on the reader – in common with Dr Solomon's unscientific view as I have discussed in 4.2 – that the weather and climate are the same

> Scott was aware that meteorology would play a major part in this polar trek. He thoroughly investigated weather conditions during various trips in March, July and September 1911, and discovered that temperatures at the barrier (the Ross Ice Shelf) were about 20 7F [*sic*, printer's error, should be 20°F] lower than at the Cape Evens base camp. A minimum thermometer at One Ton Camp (on the barrier) recorded a temperature of –72 7F [*sic*] in 1911, whereas measurements at Cape Evens revealed a long, 'coreless' winter with mean temperatures of about –23 7F. [*sic*]

Indeed, the question of the relationship between minimum near the surface (or surface) temperature recorded at One Ton Depôt and Cape Evans during the winter of 1911 is open. From the following part of Dr Lüdecke's review, it is evident that she gets confused as to what issue Dr Solomon's thesis is about

> Solomon shows that Scott's party encountered a very unusual cold snap at the end of February 1912, unlike any recorded since. She critically evaluates all the data taken during the crucial months, and compares these with modern temperature data.

Unfortunately, Dr Lüdecke does not inform the reader what scientific method was used to show that "Scott encountered a very unusual cold snap". Is comparing temperature data a scholarly method, or just a Cherry Picking fallacy?

Dr Beau Riffenburgh's review[135] appeared in a journal called *Endeavour*, a quarterly magazine reviewing the history and philosophy of science. Dr Riffenburgh right from the start picks up the point

> In a nutshell, her argument is that, despite Scott and his men gathering, analysing and putting to use a great deal of diverse information about the Antarctic in planning the journey to the Pole, the polar party did not survive the return from the South Pole because of an unusual period of exceptionally cold weather for which planning could not have allowed. [They] were 'killed not primarily by human error but by this unfortunate and unpredictable turn of meteorological events' (p. xvii). The author's meteorological discussion is well researched and powerful, and it makes a welcome and valuable addition to the literature on Scott.

The above citation does not withstand my critical analysis in the current chapter and therefore the above is incorrect. Surprisingly, Dr Riffenburgh otherwise shows insight into Dr Solomon's academic misconduct and pro-Scott/anti-Amundsen biases

> First, Solomon seems selectively to take statements from accounts that prove her argument, ignoring information that does not support her contentions [We will see a prime example of this in subsection 11.1.12 – KS]. Secondly, she does not attain the 'balance' she indicates she seeks. And third, her extrapolations from the meteorological data to the conditions of the snow and ice are not fully consistent with the information gained from other expeditions, nor with more recent scientific papers.
>
> The first point can be demonstrated in part by her use of quotes out of context. One example occurs on pp. 223–224, where Solomon comments on how, on Scott's return from the Pole, temperatures of approximately –20F made the act of skiing a most difficult process, adding 'even Amundsen once described the problem of skiing in frigid conditions, writing that 'the cold affected the going at once; it was slow and unyielding.' Using this quotation is somewhat naughty because Amundsen (p. 383) was actually writing about a morning in which the temperature was actually –67.9F, more than 40F below what Scott was facing! Moreover, Solomon ignores a quotation in the pages that follow, where Amundsen has written: "Next day the temperature was –62.5F, and perfectly clear. We did eighteen and a half miles' (p. 385) …

> By way of balance, Solomon evidently means that she acknowledges the planning and execution of the expedition as a whole, and of the journey to the Pole in particular, and that she recognizes some of Scott's weaknesses. However, any balance is lost by an unnecessarily negative picture of Amundsen, in which she denigrates his extensive preparations and knowledge, and comments on the luck of the Norwegians (e.g. pp. 94, 109, 134, 179, 215) …
>
> Nowhere does Solomon's critical opinion of Amundsen appear more strongly than in the often repeated point that Scott used science as a basis for his decisions, whereas Amundsen simply chose a solution to the problem with a large margin of safety (e.g. pp. 111, 222, 278). Not only is this representation of Amundsen historically inaccurate, it also begs the question of what the scientific method is. Amundsen spent a vast amount of time in testing, analysis, and preparation, both in the North and the Antarctic, and he also gave himself an ample safety net. Conversely, if Scott's plans were based on information gained after his arrival in the Antarctic, then his scientific method clearly did not involve lengthy detailed observations, but relatively quick field studies, followed by on-the-spot improvisation.
>
> Finally, in spite of Solomon's impressive collection of meteorological data, her assertions about its relation to the snow conditions that she indicates so hindered Scott in his final month do not agree with either the observations of other explorers or those of more modern research. The essence of her argument here is that as 'temperatures dip below about –20 F, the glide is gone – destroyed by the basic thermal properties of ice' (p. 223). This is based, she says (p. 35), on the fact that temperature is the key factor in the formation of the liquid layer that allows skis or sledges to glide easily or not. She also mentions Scott's sledging party having difficulties on a day with a minimum temperature of –15F.
>
> However, both earlier and more modern scientists suggest that the temperature at which sledge runners experience this very high friction is about –40 F (Refs 2,3). This is an important differentiation, because the temperatures that Scott experienced were well above this. By contrast, Amundsen regularly commented on excellent progress made on days with temperatures far lower than those Solomon quotes, including –39 F (Ref. 1: p. 241), –41.8 F (p. 243), and –69.3 F (p. 385). Other explorers too have also recorded the ability to ski or sledge effectively in temperatures far below those facing Scott's party.

Yet the question remains: why did no one plot historical minimum temperature data recorded at base camps to see that the year 1912 and the months February and March were not particularly cold, as depicted on my Figures 3.15 through 3.17?

Finally, since very little temperature data at a similar year, time, and location were available to Captain Scott and Dr Simpson, *why* did both of them – primarily Captain Scott – know that he and his party would be struck by unusual and unexpected low temperatures? It appears to be a fundamental question in the analysis of Captain Scott's record. If one looks at Captain Scott's *Extreme Cold Snap* from the perspective of temperature simultaneously recorded at Cape Evans, then it appears that this event

did not happen. In order to account for this event, one has to create a tautology of "not being able to predict the unexpected" – the *Extreme Cold Snap*, and confine it to Captain Scott's party's location.

4.6. Dr Solomon at the Royal Society of Chemistry – Note Added in Proof

The reader may get the impression that that Dr Solomon's fallacies described above – data dragging and data falsification – are over ten years into the receding past. Unfortunately, this is not the case and Dr Solomon ruthlessly promotes her findings. More importantly, she is well aware of my findings of her fallacies and data fabrication. These were communicated to Dr Solomon on various occasions and forms at least since June 2009. Sadly, Dr Solomon did not respond and continued to promote her lies.

Dr Solomon presented a lecture for the Royal Society of Chemistry on the memorable date of Mar. 30th, 2012. Her presentation was entitled *The Coldest March: Scott's Fatal Antarctic Expedition*. It was recorded and is freely available.[136] Before the lecture, Dr Solomon was fully aware of critics of her work. She was aware of scientific misconduct by her data fabrication, as I described in the current chapter. Despite that, she went on and continued to misinform her audience by repeating her most glaring hoaxes. I will not critically review here her entire lecture, but instead concentrate on one part directly related to the *Extreme Cold Snap*. This part of Dr Solomon's lecture starts at about 53:17 during the recording time, and the transcript of it together with my comments follows. The transcript of Dr Solomon's talk is given in italics.

So how unusual is such a period of persistent cold? Is what Scott told us about that being reason sudden advent of cold weather, being the reason for their deaths is potentially true?

On and on, Dr Solomon asks *post factum* questions. She knows very well that by committing a fallacy, she will find affirmative answers to raised questions. So what is the point of asking? If Dr Solomon would have posited this question, and if she did not find "a similar cold weather in 1988," then would she conclude that Captain Scott was telling lies? I think she would not tell the readers of her publications this.

I spent a lot of time studying this and this updated figure of shown in my book The Coldest March and now goes up to 2011 and the data for 2012 will be available soon, but I don't have them on there as they are not completely quality checked yet.

Without being malicious, I only observe the argument of time is worth nothing.

But you can see that there is 50 years roughly of data from New Zealand base at the edge of Barrier, Scott Base and it's warmer than it is in the centre of the Ice Shelf by quite a few degrees, but it has similar temperature variations. And you can see that 1988 was the coldest year in 45 years at the New Zealand base. That's the only year that the temperatures on the Ice Shelf were comparable to these Scott experienced.

Dr Solomon foists the view on the audience that she used 50 years of temperature data. But she fails to say why temperature data from Scott Base has anything to do with Captain Scott. She also fails to say why the entire year's temperature has anything to do with Captain Scott's three weeks of low temperatures. The investigative reader may also notice that Dr Solomon in the above account moves even further in her nonsense. Here, she even contradicts her own Cherry Picking Fallacy when she comments that "the centre of the Ice Shelf … has similar temperature variations [*sic*]," as Scott Base on the edge of the Barrier does. Indeed, she is sensibly saying that (see Fig. 1.7) there is a relationship between temperatures on the Barrier and on its edge. But then she fails to say that while Captain Scott reported extremely low temperatures, the respective temperature record at Cape Evans was not particularly low, as compared with historical data: *Discovery Expedition*, *Nimrod Expedition*, and *Terra Nova Expedition* (Fig. 3.15–3.17), and modern (Fig. 3.5) temperature data. While observing similarity of temperature trends on and at the edge of the Barrier, Dr Solomon fails to recognize that these trends are not conserved (observed) in Captain Scott's and the Cape Evans records.

So station 4 is the one at almost 80 degrees south, station 5 is 84 degrees south and you can see that Scott's temperatures were a bit colder in almost every year with the exception of this one [1988] and possibly this one. There was one more year since I wrote my book which looks like it might have been rivaling Scott's temperatures, that was 2005. So you can see that these temperatures were very, very unusual. Typical temperatures are a good 15 degrees warmer.

Again and again, Dr Solomon foists the audience that Captain Scott or anyone should expect to record a typical temperature. However, she is not saying that the typical temperature was calculated as an average temperature, and all its fluctuations were dropped into a function machine called average. It is also not true that 2005 is second to 1988's coldest year. It is actually 2004 that is second coldest.[137] The reader should recall that Dr Solomon presented during the lecture her updated figures. However, the errors, data dragging, and falsification are the same as on old figures, as I discussed in detail in subsection 4.1.1 of the present chapter.

Simpson wrote that "the Barrier could be traversed many times without again encountering such low temperatures so early". In fact, he told Cherry-Garrard that he thought that the Barrier can be traversed in 9 years out of 10 and they struck the unlucky 10th one. I do not know how he did it, but he was just about right [Solomon points toward her figure], *because it is something like one in every 10 to maybe 20 years that sort of these conditions prevail. So they had a forecast of temperatures quite a bit warmer what they experienced and that took them tremendously by surprise.*

At least here, Dr Solomon speaks the truth when she acknowledged that she does know how Dr Simpson got this figure. What is Dr Solomon's point of citing Dr Simpson as gospel if she cannot verify his conclusion? Dr Solomon does not know how Dr Simpson got it, but she knows that it is right! All temperature data from Captain Scott's expedition are available in Dr Simpson's meteorological report. Why did Dr Solomon not verify this conclusion using Dr Simpson's data? The answer is simple. No such verification is possible using Dr Simpson's data! Even using modern

data, one cannot arrive at a probabilistic argument. Dr Solomon's guess of "10 to maybe 20 years" is codswallop, as the data is incomplete and unrepresentative. The notion that "they [Scott] had a forecast" is a specious falsehood. So is the claim that the "9 times out of 10" quote came from Dr Simpson.

Was the instrument just wrong? That was the first question that I asked myself and I realized that I could check this because there was another thermometer very close to where they were that ought to give you roughly the same kinds of temperatures, not exactly the same, but on conditions that were calm-and it wasn't always calm-but in calm conditions Cherry-Garrard went out to look for Scott [*sic*] *and he took the Russian dog driver and two dog teams, he went as far as One Ton Depot, he was only a few tens of kilometers away* [*sic*] *from where they were but he did not manage to retrieve them, he did measure temperature every day while he waited as he they all had been trained to do* [*sic*] *and you can see that the temperatures he measured at Mar. 5th were very close to the ones that Bowers measured a few degrees away* [*sic*]. *The same thing on Mar. 8th, 10th within a couple of degrees. So clearly there was nothing wrong with the instrument.*

What did this do to them …

The above mention of her investigation of a possible malfunction of Captain Scott's thermometers represents one of her many instances of data dragging/data picking and thus scientific misconduct.

First of all, Dr Solomon misleads the audience about the possibility of testing the accuracy of thermometers. On her figure she used during the lecture (and in the PNAS article and the book), she used *daily minimum* temperature records of Captain Scott, and therefore the *minimum temperature thermometer* record (see subsection 4.1.1). In here, she is comparing results of ordinary thermometer records. Thus even if she proves – which is not the case – that ordinary thermometers of both parties had not malfunctioned, she does not prove the same about the minimum temperature thermometers. One may suggest that the above is an oversight by Dr Solomon and cannot qualify as scientific misconduct.

However, before examining Dr Solomon's misconduct, let me cite a general account of a cherry picking fallacy presented by Dr Richard Somerville during his testimony in the US House of Representatives[138]

> Choosing to make selective choices among competing evidence, so as to emphasize those results that support a given position, while ignoring or dismissing any findings that do not support it, is a practice known as "cherry picking" and is a hallmark of poor science or pseudo-science.

Under the above fundamental thermometer issue, let me look at Dr Solomon's shot to prove to the audience her conjuncture that: If during calm conditions measured simultaneously air temperatures at locations attained in early March 1912 by the Captain Scott and Cherry-Garrard parties were roughly the same, then Captain Scott's party minimum thermometer was not malfunctioning.

We know already from the current chapter how to analyze Dr Solomon's fallacious "*if … then*" statements, and I will not continue along these lines, but leave it to the exploratory reader. Instead, I will go on directly to show Dr Solomon's cherry picking scientific misconduct. The best way to do so is to show the respective

temperature data as given by Dr Solomon during her lecture (recording time 55:25), and as measured by Lt Bowers and Cherry-Garrard and collected by Dr Simpson. The respective data is shown in Tab. 4.4. This data is divided into two sets. One set as given by Dr Solomon, and the second as measured by observers. The set of Dr Solomon's data is described by her as "Early morning minimum temperatures (°F) in calm conditions"[139] Dr Solomon could not do much with Lt Bowers' data, as very few entries were recorded in March 1912. Therefore, she represented this data as recorded. That is, early morning records as given in Tab. 4.4. However, to prove her thesis, she cherry picked suitable data from the Cherry-Garrard record! Only on Mar. 10th a coincidence of temperatures is observed, but for Mar. 5th and 8th the true morning differences are 15.5°F and 9°F, respectively.

Dr Solomon's remark that *"you can see that the temperatures he* [Cherry-Garrard] *measured at Mar. 5th were very close to the ones that Bowers measured*" is her deliberate lie, as the temperature difference was 15.5°F and not 3.5°F. A similar lie is observed also on Mar. 8th. Dr Solomon choosing temperatures to make selective choices is a scientific misconduct. Additionally, Dr Solomon is lying through her teeth by saying that the conditions were calm. See Tab. 4.4 for wind velocities which were not gale strength (7–8) but not calm at all.

Therefore, Dr Solomon does not prove her conjecture that the Captain Scott party thermometer was not malfunctioning. She proves nothing except that she tells bare-faced lies to the audience.

Table 4.4. A collection of temperature data attributed by Dr Solomon to Cherry-Garrard and Lt Bowers during her lecture, along with the true data as collected by Dr Simpson. All temperatures are in °F and the wind velocity is given in the Beaufort scale. Dr Solomon described Cherry-Garrard and Lt Bowers' data as "Early morning minimum temperatures (°F) in calm conditions."

Date 1912	Cherry-Garrard (Solomon)	Bowers (Solomon)	Cherry-Garrard (Simpson)	Bowers (Simpson)	Wind (Cherry-Garrard)	Wind (Bowers)
Mar. 5th	–34.0	–37.5	**–18.5**(9am) –21.0(2pm) –34.0(8pm)	–37.5(5am) – no data – no data	2	2–3
Mar. 8th	–37.0	–38.5(?)[1]	**–28.0**(9am) –23.0(3:30pm) –37.0(8pm)	–38.0(5:30am) –35.2 (?)[2] –38.5 (?)	2	2
Mar. 10th	–33.5	–35.0	**–33.5**(8am) –23.0(1:45pm) –16.5(7pm)	–35.0(6am) – no data – no data	1–2	No data[3]

1 Dr Solomon cherry picked this temperature. However, Dr Simpson did not give its recording time. It is close to the temperature of –38.0°F recorded by Lt Bowers at 5:30 am, Mar. 8th, 1912.

2 Although Dr Simpson gives the temperature, he does not give the time of temperature recording.

3 No data in Dr Simpson Vol. III, Tab. 72, *cf.* p. 642. However, Captain Scott gives on Mar. 10th 1912 the following account: "This morning it was calm when we breakfasted, but the wind came from W.N.W. as we broke camp. It rapidly grew in strength. After travelling for half an hour I saw that none of us could go on facing such conditions. We were forced to camp and are spending the rest of the day in a comfortless blizzard camp, wind quite foul."

Let me without going into specific analysis just mention additional problems with Dr Solomon's above expounds:

1. why she does not explain why during calm conditions one should observe temperature similarities across the Barrier,
2. why the temperatures between remote locations must be very similar,
3. why these similarities occur only in the morning,
4. why she assumed that Cherry-Garrard's thermometer was not malfunctioning,
5. why she assumed that Cherry-Garrard was able to read the correct temperature,
6. why she is saying that in early March 1912 the both parties were "*a few tens of kilometers away*",
7. why after four seconds of lecturing, she is saying that the parties were "*a few degrees away*" (one latitudinal degree is 110.6 kilometers),
8. why she says that Cherry-Garrard was a few tens of kilometers from Captain Scott party "*but he did not manage to retrieve them*",
9. why she is counterfactually suggesting that that Cherry-Garrard was dispatched to "retrieve them".

The above transcript represents about 2 minutes of her lecture, which lasted well over 1 hour. Because verbally addressing the audience is a more dynamical event than a written (and corrected) text, one can observe how Dr Solomon is mixing facts, concepts, and places. The reader may rightly expect that the remaining parts of her presentation are dotted with errors, fallacies, and scientific misconduct. However, I will not review and/or comment on these instances, and leave it to the reader to hunt (or not) the errors. I just end this note on a sarcastic tone by citing Dr Solomon's wording on her last projected slide: "Thank you for the opportunity to tell this story of science, exploration, and Antarctica".[140]

4.7. Synopsis

Since 1999, I was aware of a number of critical logical issues related to Drs Solomon and Stearns' paper published in the Proceedings of the National Academy of Sciences (USA). I was mainly concerned with the Gambler's Fallacy committed by the authors in their proof of the accuracy of the temperatures reported by Captain Scott and Lt Bowers in late February and March 1912. After reading her book *The Coldest March* in late 2001, I got even more aggravated as the number of unacceptable issues increased proportionally to the volume of the book. Towards the end of the first decade of this century, I started to dig into the related issues in a more systematic and careful way. Soon, it become evident that not only did Dr Solomon commit fallacious reasoning, but also that her work is riddled with errors, counterfactuals, data dragging, data fabrication, and misinterpretations.

To my great astonishment, *all* of Dr Solomon's weather-related figures, which were made by her to support and illustrate her accounts presented in the main text of the book, were in different degrees dotted with errors, data dragging, and data fabrication. In many instances, Dr Solomon's motives for starting an argument with certain issues were a complete riddle. However, if supported with graphs of falsified meteorological data, these issues take on a new life of supporting her general thesis,

which proved that Captain Scott and his party perished because of an unusual ("not normal") Cold Snap in late February and March 1912.

The list of Dr Solomon's errors, hoaxes, data dragging, and data falsification is astonishing. Indeed, unbelievable in terms of research misconduct. Did Dr Solomon deliver what the people wanted to hear? Unlike myself, she certainly delivered what Captain Scott's descendants wanted to hear[141]

> It would be an understatement to say that Scott's descendants were and remain unhappy with the picture painted in the Huntford book. Falcon Scott, grandson of the famous explorer, has welcomed the publication of a more sympathetic account of events on the fatal journey.
>
> "We're very pleased about this," he said. "We always knew that the weather was bad – that was all in his diaries – but we didn't know how unusually bad it was." He condemned some of the "rubbish" written about his grandfather in the past. "This new book goes some way towards putting the record straight."
>
> …
>
> Those are the wishes of Scott's heirs, who have spent decades defending him against Mr. Huntford and subsequent critics. "Basically, the Scott family attitude has been that this is a whole lot of rubbish. We knew he was a good guy. Susan Solomon is going to vindicate him," says R. [*sic*] Falcon Scott, the explorer's grandson, a builder who runs vacation lodges in Scotland. "My grandfather was unlucky, just as this new book will demonstrate."
>
> …
>
> There is delight among Captain Scott's relatives that a new book by a meteorologist, The Coldest March, places blame for the failure of his 1912 Antarctic expedition on freak weather conditions. At the launch this week, his daughter-in-law, Lady Philippa Scott, said: "It's very fashionable to denigrate so it's wonderful that something has been written to set the record straight. My husband was very upset by the criticism of his father. For this book to justify everything is wonderful and I just wish he could have been here to read it."

However the bad news is that Dr Solomon's work did not "set the record straight". On the contrary, Dr Solomon's fallacies and data fabrications aggravated many – including myself – and sparked a new research on Captain Scott's expedition. The results are presented in this book.

I wonder, like Lady Philippa Scott cited above, what Sir Peter Scott (and for that matter Captain Scott) would say about Dr Solomon's account. Would they, like a scientist, follow and review step by step my criticism of Dr Solomon's fallacies, or would they fall under her spell and confirm that as of now "the record [is] straight". Since Dr Solomon substantiated his father's meteorological record, though no one was questioning it, the answer to this rather rhetorical question is simple.

However, the question arises: is it possible, over one hundred years later, to get *educated* (scientific) insight into the actual weather experienced by Captain Scott's party in late February and March 1912? Due to the temperature record at Cape Evans, it is indeed possible to get educated insight into the weather record of Captain Scott's party. We will find this insight in Chapters 7 and 8.

Chapter 5

Historical Scrutiny of the Meteorological Record of the *Terra Nova Expedition*

Mundus vult decipi, ergo decipiatur.

Petronius[1]

The whole plan hinged upon the natural curiosity of potatoes.

Stanisław Lem[2]

If I look into any book on world history, like for example the concise volume of *History of the World* by J. M. Roberts, I cannot find anything related to Captain Scott's expeditions. If I look into more extensive accounts, this story hardly appears as a part of world history. Yet, my tacit knowledge tells me that the number of books directly and indirectly related to Captain Scott's life, expeditions, and his comrades does not reflect its absence in the wider context of global history.

A fairly comprehensive list of biographies of Captain Scott-related biographies of the crew as well as associated accounts was presented in an annotated edition of his Journal of the *Terra Nova Expedition* in 2006.[3] Every one of these publications has had its own share of dealing with the weather and meteorology of Captain Scott's journey to the South Pole. However, contrary to Sir Ranulph Fiennes' assertion that[4] "over fifty biographies have since been written about their leader" Dr Jones lists only eight biographies[5] which, with the ones published after[6] the list was prepared, give nine biographies about Captain Scott – still a fair amount of books to read and study.

Before Dr Solomon's publication, the issue of the weather during Captain Scott's South Pole journey attracted – besides the original discussion by the members of the *Terra Nova Expedition* – none or little attention. Ever since being instigated by Dr Solomon in her book, and to a lesser extent by the PNAS paper, a fair number of unsubstantiated conjectures related to the weather have been formulated.

For anyone who has a minimum understanding of everyday meteorology, and for everyone who ventured and read previous chapters of [this] book, Dr Solomon's fallacious presentations are evident. However, how did other people's method of "copy and paste" prevail and her fallacies spread? The latest surge of media publications prompted by Captain Scott's centennial of reaching of the South Pole showed that a good number of weather related "facts" have been fabricated. Interestingly, various authors, by arguing the scientific purpose and values of Captain Scott's *Terra Nova Expedition*, presented unscientific and fallacious arguments by arguing pseudoscience. What bothers me the most is how it is possible that someone – a seemingly educated person – can produce the following account.

The science editor at the BBC, Megan Lane, in the article titled *Four things Captain Scott found in Antarctica (and one that found him)*[7] examines the pillars of the *Terra Nova Expedition* and lists them in the following order:

- Emperor penguin eggs,
- Missing link fossil,
- Wildlife in action,
- Rare weather system.

Although I disagree with such an understanding of Captain Scott's contribution, here I will not argue my case for all of these points, but only comment on the last one which is directly related to the main theme of this book.

Ms Lane is straightforward in her outlook when she accounts the weather

> At a time of year when temperatures are a relatively balmy –28C [*sic*], Captain Scott's five-man [*sic*] polar team perished during an extended cold snap when the mercury plummeted to –40C [*sic*].

The origin of the following: (1) "balmy –28°C" temperature, (2) "fifth-man" instead of one perishing during the cold snap, and (3) "mercury plummeting to –40°C" although mercury's freezing point is –38.83°C, is entirely unknown.

However, the just mentioned counterfactuals have little importance in relation to what follows in the next line by Ms Lane

> The detailed forecast drawn up by meteorologist Dr George C Simpson for the push to the Pole showed no sign of this unfortunate weather event.

It is indeed an *overpowering* comment. I picture the situation like this. It is September 1911, Captain Scott and Dr Simpson are sitting in one of the cubby-holes of the hut at Cape Evans and discussing Antarctica's weather. Unexpectedly, Dr Simpson presents a sheet of paper and informs Captain Scott that it is his forecast of temperatures, air pressures, wind velocities, wind directions, blizzards, snowfall, and cloudiness during the planned journey from November 1911 through to April 1912. Captain Scott rolls up the sheet and says, "Thank you, Sunny Jim."[8]

However, it appears that Captain Scott had made his plan of the South Pole journey well before and at a "very early date"[9]

> I don't know what to think of Amundsen's chances. If he gets to the Pole, it must be before we do, as he is bound to travel fast with dogs and pretty certain to start early. On this account I decided at a very early date to act exactly as I should have done had he not existed. Any attempt to race must have wrecked my plan, besides which it doesn't appear the sort of thing one is out for.

Captain Scott learned about Captain Amundsen's real intentions from Lt Victor Campbell on Wednesday, Feb. 22nd, 1911[10]

> But every incident of the day pales before the startling contents of the mail bag which Atkinson gave me – a letter from Campbell setting out his doings and the finding of *Amundsen* established in the Bay of Whales.

This shows that Captain Scott's plan of the South Pole journey was not related to the appearance of Captain Amundsen in Antarctica and/or a "detailed forecast

drawn up by meteorologist Dr George Simpson". Did Lt Shackleton have such a "detailed forecast" made up by his meteorologist Lt Jameson B. Adams? Did Captain Amundsen have a forecast?

Indeed, the plan to push south was a result of sledging velocity and the distance to be covered. No plan, however complex, could change this simple reality. It is a long forgotten truth that one of most important exploratory discoveries of Captain James Clark Ross (1800–1862) was his finding the Barrier, the gateway to Antarctica's interior and the South Pole. If by any chance the Barrier area was not discovered at the early stages of Antarctica's exploration, then any attempt to reach the South Pole from other coastal areas would significantly postpone conquering the South Pole. At least for the British explorers; because of sledging velocity Captain Amundsen may again forestall everyone.

Despite that, Ms Lane after describing Captain Scott's weather related expounds in the *Message to the Public* reaches her conclusion by posting a fallacious question, followed with a fallacious answer

> An unexpected and rare misfortune, or was the forecast simply wrong? The former, says Susan Solomon, an expert in atmospheric science and author of The Coldest March. Simpson's meticulously analysed weather data would have been correct in almost any other year, but 1912 was the one in which the Antarctic winter started hard and early.

The above comment illustrates how Dr Solomon's fallacious reasoning and writing percolated into many people's understanding of Captain Scott's last expedition. What is the logic of the question "An unexpected and rare misfortune, or was the forecast simply wrong?" and subsequent answer to it? What is the causal relationship between the perishing of Captain Scott and a wrong forecast or rare misfortune? What is the relationship between unexpected weather and forecast? And finally, did Dr Simpson forecast the weather or climate?

Even without reading Chapter 4, where I examined Dr Simpson's work, one can with certainty claim that Dr Simpson could not predict the weather for the period November 1911 through to April 1912 along the Captain Scott party's route. Even today, and I guess for a long time from now, the forecasting of weather along Captain Scott's route is far too difficult a problem to be satisfactorily achievable.

One important remark must be added here that speaking about forecasting without specifying forecasting accuracy is pointless. Forecast error is the difference between the actual value and the forecast value for the corresponding period. The whole forecasting business is about cutting down the forecast error to the value that is satisfactorily (acceptable) in scientific and commercial applications. The forecast error cannot be replaced by Dr Solomon's vague account of Dr Simpson's "stunning accuracy".

It should be emphasized that the above-mentioned sheet of paper with Dr Simpson's prediction was never found, and actually did not exist – it was invented by me, and presumably Dr Solomon before me. All data and discussion presented in Chapter 4 were post-factum observations and conclusions. Captain Scott, Captain Amundsen and Lt Shackleton were "weather-blind" in their predictive powers while exploring the Antarctic continent.

Following the above arguments by Ms Lane and previous arguments by Dr Solomon, one can estimate Dr Simpson's maximum hindsight prediction (*hindsight*

forecasting) error. Because Dr Simpson did not predict the *Extreme Cold Snap*, his predicted averaged maximum error must be bigger than or equal to about ±20°F. If one is satisfied with such prediction accuracy, it is fine. However, if one is not, then the search for new prediction (forecast) methods is needed. In the following chapters, I will present and discuss modern predicting methods which will enable one to re-examine Captain Scott's temperature data in late February and March 1912. These methods will allow me to get a better insight – due to better prediction accuracy and usage of the scientific method – into real temperatures along Captain Scott's route in 1912.

However before proceeding, let me critically examine only the most recent accounts of weather during Captain Scott's South Pole journey. This analysis will complete my critical examination of all weather questions, descriptions and accounts related to Captain Scott's journey to the South Pole.

5.1. Huntford's *The Last Place on Earth*

Roland Huntford, though this is not saying much, remains the greatest historian of polar exploration of the late nineteen and early twentieth century.[11] For him,[12] or rather according to a Swedish and Norwegian saying, there is no bad weather, only bad clothing. We all know his arguments and critique of Captain Scott. However, Captain Scott 's claim of disaster due to exceptionally low temperatures in late February and March 1912 is not easy to reassess. On this issue, Huntford seems to follow Silas Wright's belief, as I described in section 2.3.

In 1979, when the first print of *The Last Place on Earth* appeared under the original title *Scott and Amundsen*, virtually nothing – more than in 1911/1912 – was known about the Barrier interior's temperatures. It is true that yearly temperature data was available from manned weather stations at McMurdo/Scott Base and the South Pole. It is also true that using the continuity assumption, one would expect that the temperatures on the Barrier should be somewhere between temperatures at the McMurdo/Scott Base and the South Pole. But the question of *real* temperature values at different Barrier locations was still wide open.

Although it was evident from the *Message to the Public* that the weather at least from Captain Scott's point of view played the most important role in his "disaster", Roland Huntford chose not to address the issue in any special way. Only towards the end of his book, and while describing the last days of Captain Oates, did he address the issue of weather and temperatures[13]

> Three days later, Scott recorded:
>
> *Poor Soldier nearly done. It is pathetic, enough because we can do nothing for him … We none of us expected these terribly low temperatures.*
>
> Yet all his experience told him what to expect. The *Discovery* told him so. Shackleton told him so. His own men told him so; or could have, if he had been prepared to listen. The year before, at the same time, Teddy Evans had found low temperatures and hard going on the Barrier. Scott nonetheless planned to be out three weeks or four weeks later. Naval officers have been court-martialled for less.

The investigative reader after reading the above comment and my discussion in previous chapters would easily notice that indeed Huntford is also falling into the weather and climate trap. Sparse temperature data (see Chapter 3) were entirely insufficient in whatever analysis Captain Scott could make. To put it simply, no weather planning was possible. Even today, with all the temperature data available from weather stations scattered on the Barrier, no one can predict in November the weather in the following March. The conjecture about weather predictability several months in advance today and back during Captain Scott's preparations to the South Pole journey is scientifically and historically false. Therefore contrary to Huntford's suggestion, he instead of Captain Scott should face a court-martial.

One should also notice Huntford's additional suggestion that "Scott nonetheless planned to be out three weeks or four weeks later" is also unfounded. The time which Captain Scott expected to be out did not result from any specific plan. It resulted from an initial assumed velocity of the party(s) during the entire journey. Indeed, it remains a mystery how Captain Scott arrived at his figure of about 10.1 miles/day, but that is what he assumed. However, he was able to maintain this velocity until his outward journey from the South Pole and even increase it to a fair 14.3 miles/day on the inward journey until the party reached the Beardmore Glacier. This is illustrated on Fig. 5.1. This figure is indeed interesting. After reaching the Glacier, and after a gradual descent from it, the party moved more slowly than before on the same route but up the glacier. It may have been due to fatigue. However, since Feb. 2nd, 1912 at

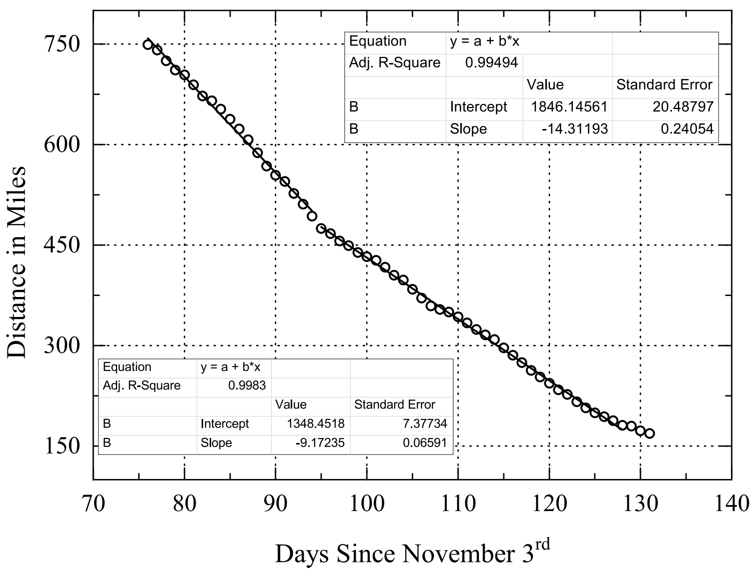


Figure 5.1. Captain Scott's inward distance in days since Nov. 3rd, 1911. The first data point in the upper left corner is Jan. 17th, 1912. The size of data points (○) is exaggerated for better presentation. To estimate actual velocity, the linear least squares fitting was performed for two data sets. The first one is from Jan. 17th through Feb. 4th, 1912, with the result $\upsilon = 14.31 \pm 0.24$ miles/day. The second interval is from Feb. 6th through Mar. 9th, 1912, with the result $\upsilon = 9.17 \pm 0.07$ miles/day. Geographical miles have been used.

no instance did Captain Scott mention his concern about the unhurried pace of their progress down the Beardmore Glacier.

Returning to Huntford's assessment of reported temperatures, there remains his overall rationale about Captain Scott[14]

> In fact, the temperatures, between –30° and –40°C., were not exceptionally low for the season of the year. But all their defences against the cold were down. By now they were all probably suffering from scurvy in varying degrees.

One should observe that Huntford gives an acceptable range of temperatures. However, that is all that Huntford has to say about weather related issues in Captain Scott's South Pole journey. Huntford addresses the issue of weather a little more, but still along similar lines, in his recent book where he brings together the expedition diaries of Captain Scott and Captain Amundsen. Besides a number of different arguments presented in the Epilogue, Huntford briefly recounts the weather issue[15]

> Much effort has gone into bolstering Simpson's original contention that an unexpected cold snap in March 1912 finished Scott off. This hides a double hypocrisy. On the one hand, the historical apologists *need* their sacrificial hero; on the other, they wish to absolve him of all blame. They want it both ways. They would have been mortified if Scott had returned defeated and alive.

Sacred words, but without directly mentioning Dr Solomon's corrupt effort. However, in the light of Chapter 4, I or no one else would call Dr Solomon an apologist. Roland Huntford makes this summarizing point[16]

> Weather is no excuse. If Scott really was caught unawares, it suggests estrangement from Nature added to criminal optimism.

Being critical of Captain Scott, Huntford is also critical of Dr Simpson who according to him "joined the tacit agreement to promote his leader's reputation," and that Dr Simpson[17]

> … in 1926 he published a book to prove that *unexpectedly* bad weather *alone* was Scott's undoing. Simpson evidently did not know the dictum that there is no bad weather, only bad clothing, and that furs could have saved the polar party from extinction, as Amundsen has repeatedly shown.

The "book" (see Chapter 5 reference 41) to which Huntford is referring was a "transcript" of Dr Simpson's Halley Lecture delivered in Oxford on May 17th, 1923. In section 3.3, I critically examined this lecture, and I have shown there that Dr Simpson, instead of Huntford's dictum, produced counterfactuals related to temperatures at Cape Evans.

5.2. Sir Ranulph Fiennes' Faithful Enthusiasm

Humans thrive at a core temperature of just under 99°C [*sic*]. *At about 95°C* [*sic*] *they begin to shiver uncontrollably and become 'sleepy'. At 93°C* [*sic*] *amnesia sets in, and at 91°C* [*sic*] *apathy. At 90°C* [*sic*] *the heart begins to slow down, and at 87°C* [*sic*] *hypothermia sets in: without help to rewarm, death will follow quickly.*

Sir Ranulph Fiennes[18]

Sir Ranulph Fiennes is a British adventurer, who in the book titled *Captain Scott* presented his account of events. His book clearly declared that it was attempting to *restore* Captain Scott's reputation, which according to the author had suffered "wrongly and deliberate malice [which] ruined a dead man's once fine reputation".[19] However, Sir Ranulph's work does little to advance historical analysis and does not bring any new facts. On the contrary, Sir Ranulph while working with the historical material is changing inch by inch the perspective, or deliberately ignores well-known facts. His dealing with the meteorology of Captain Scott's expedition is an example of how the author with strong convictions towards historical material is able to gradually push the facts and data to prove his belief.

Sir Ranulph's book – the original Hodder & Stoughton edition – came out about three years after Dr Solomon's *The Coldest March*. For that reason, her work was a wind to Sir Ranulph's sail and he essentially relied on Dr Solomon's findings[20]

> What is now certain, since the publication of *The Coldest March* by United States atmospheric scientists Dr Susan Solomon in 2000, is that Scott's group were unlucky enough to experience the year of the rogue wave.

Indeed, a stunning conclusion of the certainty of luck or the contrary. It confirms that Sir Ranulph did not read Dr Solomon's book, and even more importantly did not critically and analytically look at her methods and arguments. In addition, he coined the notion of "the year of the rogue wave". However, the author evidently forgot to observe that a wave phenomenon is not localized, but spread over space and time.[21] Thus, a simple and natural question arises as to why Sir Ranulph's *rogue wave* was not simultaneously recorded at Cape Evans?

One page later, Sir Ranulph continues[22]

> The freak weather began at the end of February in fits and starts and was recorded in Bowers' log until 19 March. Minimum temperatures day after day were 40°–50° [in degree Celsius – KS][23] colder than [*sic*] those that Teddy Evans's returning group had experienced on the same route only a month before.

If I recalculate the centigrade temperatures suggested by Sir Ranulph, I get equivalent Fahrenheit temperatures in the range of 40–58°F. The average minimum temperature measured by the Second Return Party in the proximity of One Ton Depôt was about –1.8°F, for Feb. 3rd–9th, 1912.[24] Thus according to Sir Ranulph,

Captain Scott's party encountered temperatures in the range of 42–60°F below zero. In the period under consideration, Feb. 27th through Mar. 19th, Captain Scott's party reported minimum temperatures whose average was –39.2°F (see Fig. 4.5). This is a gross exaggeration by Sir Ranulph of Captain Scott's already exaggerated conditions, and he fabricated a double "rogue wave". Besides, Sir Ranulph is erroneous by saying that Lt Bowers' meteorological log continued until Mar. 19th, 1912.[25]

The temperatures reported by Captain Scott were well above the temperature span suggested by Sir Ranulph. One would advocate that this overestimation of the severity of temperatures was not intentional. However, this is not the case, and just ten pages later Sir Ranulph makes an even more colossal exaggeration[26]

> On 13 March they woke to find a strong wind blowing from the north with a temperature close to –40°C [–40°F]; a windchill factor of over –90°C [–130°F].

First, I do not know where this data is taken from, as Dr Simpson's table with meteorological data ends on Mar. 12th. Secondly, Captain Scott's journal has no entry on this day. But, if we assume Sir Ranulph's figures are a true account, then the –90°C [–130°F] windchill is staggering. The windchill index (factor) is determined by the heat loss caused by the wind and air temperature, and its calculation gives the apparent temperature felt on exposed skin. The National Weather Service (USA) uses the following equation to calculate the windchill index T_{WC} (in °C and km/h)

$$T_{WC} = 13.12 + 0.6215\, T_{air} - 11.37\, \upsilon^{0.16} + 0.3965 T_{air}\, \upsilon^{0.16}$$

where air temperature T_{air} is in Celsius digress and velocity of wind υ in km/h. The observer should notice that this equation is valid *if* temperature is given in centigrade and wind velocity in kilometers per hour. If one is using say Fahrenheit and mph then the above equation has a similar form but different digital coefficients.

Taking Sir Ranulph's windchill index $T_{WC} = -90$°C (–130°F) and assuming that the above empirical equation is valid for high velocities (which is not true)[27] of wind $\upsilon \gg 118$ km/h (73 miles/h) (that is hurricane force or greater than 12 in Beaufort scale), one can calculate the wind velocity encountered by the Captain Scott party on Mar. 13th, 1912 according to Sir Ranulph, with the astonishing result of about $\upsilon \approx 734$ km/h (≈ 456 mph). Whichever way you look at it, it is nonsense.

I again ask the question of whether it was or was not Sir Ranulph's intention to mislead the readers about the actual weather conditions reported by the Captain Scott party. Is this possible that the above errors are just unintentional ones? However, I am convinced that the above data dragging and data falsification was intentional. The proof follows.

Throughout his book Sir Ranulph, in order to amplify his arguments, intertwines Captain Scott's story with his own experience to show his expertise in polar exploration. Right from the beginning of Chapter 16 titled *Intimations of Tragedy*, Sir Ranulph describes his own adventure[28]

> When I visited the Pole huts with Mike Stroud in 1993 I set up a beacon which bleeped our position strait back to Britain by satellite. We arrived there at 6 p.m. on 16 January and, as we crossed the Pole itself, we were immediately at 6 p.m. on 17 January, gaining an instant twenty-four hours in

> time just as Scott had precisely eighty-one years before to the day. We stayed at 90° south for one hour in our tent: most of the Pole inmates were asleep. The windchill factor was suitably –90°C [*sic*]. I altered my compass setting's magnetic variation in readiness for our onward journey to the Beardmore Glacier. Scott's navigator, Bowers, would have done likewise but with a different setting since the magnetic pole is always on the move.

The above is a lie when he is saying that "The windchill factor was suitably –90°C". Actually, it is not a big deal to verify it. Since near surface air temperature is constantly monitored at the Amundsen-Scott South Pole station, one can easily get suitable temperature data and using the above formula calculate the windchill factor (temperature), with the results shown in Table 5.1. It is evident that Sir Ranulph's windchill factor of –90°C is nearly twice as big as the –43.1°C resulting from the worst weather conditions on Jan. 17th, 1993.

Table 5.1. Suitable weather data and respective windchill temperature (factor) as recorded at the Amundsen-Scott South Pole station on Jan. 17th, 1993. The weather data were taken from the University of Wisconsin's Antarctic Meteorological Research Center Database.[1]

January 17th, 1993/The South Pole Station
Average temperature T_{av} = –28.6°C
Average wind velocity υ_{av} = 13.9 km/h
Average Windchill temperature $\mathbf{T_{wc}}$ **= –39.3**°C
Minimum temperature T_{min} = –30.4°C
Maximum wind velocity υ_{max} = 18.4 km/h
Maximum Windchill temperature $\mathbf{T_{wc}}$ **= –43.1**°C

1 ftp://amrc.ssec.wisc.edu/pub/southpole/50_yr_climate/

On the following Fig. 5.2, I depicted hourly temperatures, respective wind velocities, and the resulting windchill factor at the time when Sir Ranulph and Dr Stroud approached and stayed at the South Pole on Jan. 16th/17th, 1993. On the same figure, I also indicated Sir Ranulph's windchill figure of –90°C. The conclusions are palpable.

The investigative reader may observe a striking similarity between Sir Ranulph's lie about the actual weather during his stay at the South Pole, and Dr Solomon's lie about the wind force of the four-days blizzard as depicted on Fig. 4.15.

It would be of no interest further pondering on additional overcompensations of Captain Scott's temperature data by Sir Ranulph; however the above represents the spirit of the author. Belief can not only alter observations or/and their analysis, but push one to fabricate data. It is essentially the central issue of the scientific method to rely on the results of other scholars. The scientific method is not a fixed recipe, and is under continuous change and development. The most basic, rule of thumb for the scientific method was invented by a 14th-century English logician, theologian and Franciscan friar, William of Ockham. It requires that "entities must not be multiplied beyond necessity". Ockham's razor, as it is sometimes called, guided a countless number of scientists in their scientific inquiry, and it should be used in historical reasoning too.

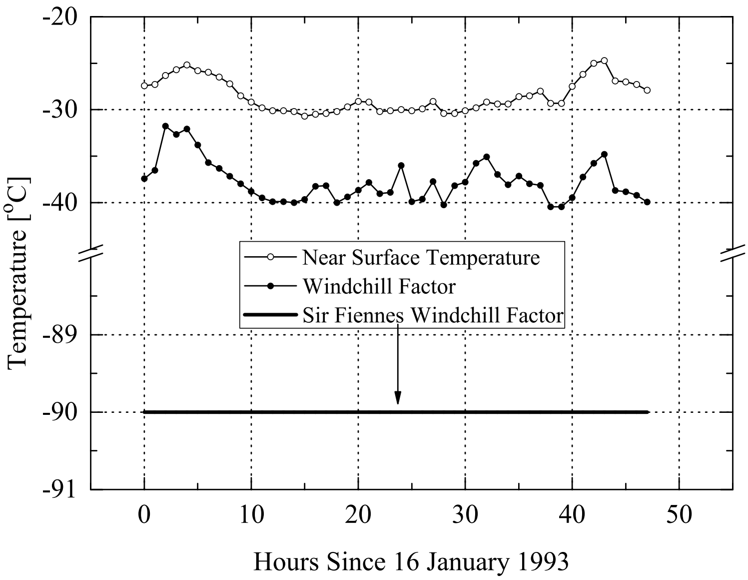


Figure 5.2. Comparison of true near surface temperatures (○) and true windchill factor (●) with the fabricated windchill factor given by Sir Ranulph Fiennes during his crossing the South Pole on Jan. 17th, 1993. Note that the temperature scale (ordinate) is broken at –45°C for the sake of convenience, and continues from –88°C until –91°C. Sir Ranulph's windchill factor is way below the actual one.

While recycling Dr Solomon's flawed conclusions and observations, Sir Ranulph added his invented incorrect data to exaggerate meteorological conditions during the final weeks of the Main Polar Party. To strengthen his pro-Captain Scott case, Sir Ranulph comments[29]

> The new meteorological records demonstrate unarguably why Scott could not in 1912 have foreseen such exceptional weather. It had seemed perfectly safe to Simpson to travel on the Barrier until the end of March. American scientists in the 1990s have established beyond doubt that March 1912 saw abnormally cold and unrelenting temperatures on the Barrier at exactly the time and place where Scott's men slowed and died. For three straight weeks temperatures were 10°C below average, conditions which have been repeated only once in the last thirty-eight years.

I will examine the logic of this comment in some detail. The first sentence is simply not true. The modern temperature, wind speed, wind direction and pressure records at a given automatic weather station *per se* demonstrate nothing. They are simple computer files coded to contain the data, and available to everyone at the internet site of the Antarctic Meteorological Research Center, Space Science and Engineering Center, University of Wisconsin-Madison, or at the British Antarctic Survey. The numbers are just numbers, and demonstrate nothing until one using the above mentioned scientific method is proposing a hypothesis, model, or theory to explain observations of meteorological data gathered during field observations. Sir Ranulph's

verdict that new (modern) meteorological records demonstrate why Captain Scott could not have foreseen frigid temperatures at the end of February and March 1912 is unfounded. Modern meteorological records combined with modern methods of data analysis, as we will show in the following chapters, point in a different direction.

When Sir Ranulph's book was published in 2003, the only available record of meteorological data at the Ross Ice Shelf was from the Schwerdtfeger automated station located in the proximity of One Ton Depôt. This record was eighteen years long, and not thirty-eight years as Sir Ranulph implied. It is also worth pointing out that Dr Solomon in her presentation concluded that minimum temperatures recorded by Captain Scott were about 10°F, and not 10°C as stated by Sir Ranulph who is very much aware of how to relate the Fahrenheit and Celsius temperature scales.[30] Because *the difference* of 1°F = $^5/_9$°C, it follows that the correct value of Dr Solomon's figure in the Celsius scale should be 5.6°C instead of the 10°C that Sir Ranulph proposed. At another instance, Sir Ranulph reported that Dr Solomon showed "that almost every daily temperature they logged was between 10° and 20° colder than in the average year."[31] Although, no indication for temperature scale is given, it is evident that it is a simple repetition of Dr Solomon,[32] who as a truly American scientist was using the Fahrenheit scale. Because Sir Ranulph is using the Celsius scale throughout his book, the respective line should be 5.5°C to 11.1°C, instead of 10° to 20°. But the latter one is more imposing in terms of possible suffering of the party, and underlines reasons for the tragic events.

Although I am only concerned with the account of temperatures by the Captain Scott expedition, I cannot pass by without mentioning the most preposterous accolades attributed to Sir Ranulph's book. His publisher Hodder and Stoughton confidently quoted a number of British reviewers[33]

> A valuable corrective to the trend of Scott debunking ushered in by Roland Huntford … One by one, and with commendable attention to detail, Fiennes explodes the accumulated myths. The world will remember Scott and, to a lesser extent, Fiennes when the memory of the mean-spirited and misleading Huntford has long since melted away. – Justin Marozzi, *Sunday Telegraph*

> Sir Ranulph Fiennes has done Captain Scott's memory some service … he has certainly written a more dispassionate and balanced account than Huntford ever set out to do – Simon Courtauld, *Spectator*

> He is uniquely qualified … because only someone who has "man-hauled" across Antarctica can know what went on. Fiennes's own experiences certainly allow him to write vividly and with empathy of the hell that the men went through. He has valuable insights into the running of the Royal Geographical Society and the mounting of an expedition, and he does indeed right some wrongs. – The *Sunday Times*

Did Sir Ranulph really write with "empathy about … the man," or did he write – in his own words – because "Scott's reputation was not as it should have been, so I decided to put the record straight and get history back the way it should be"?[34] Did Sir Ranulph really write "a more balanced and dispassionate account than Huntford ever set out to do," or did he write to resurrect "my hero[es are] Captain Scott …"?[35] His book was written with the purpose of restoring "a dead man's one fine reputation".

Sir Ranulph not only restored Captain Scott's reputation, but also lost his own by fabricating his and Captain Scott's weather data. By preaching a tribute to the "dead man," Sir Ranulph writes without restraint[36]

> When the blizzard cleared on the 11th [March 1912] they marched nearly six miles, a mileage below the rate that might avoid death for them all [*sic*1]. Oates still did his bit in the traces at –38°C [*sic*2] but that day his fingers froze to a condition of uselessness, at which point, like Taff Evans before him, he became a true liability to the others. He was now more burdensome than the thirty-five pounds of rock samples, [*sic*3] for they did not use up provisions nor cause hours of delay [*sic*4]. That day Bowers decided [*sic*5] he could no longer make the great effort required to continue the meticulous meteorological records he had kept since the start of the expedition.

The following criticism is pertinent to the above statements by Sir Ranulph, especially [*sic*3] below:

- [*sic*1] This is a misleading generalization. Actually on Mar. 12th, 1912, Captain Scott wrote "We did 6.9 miles yesterday". More importantly, temporary (one day) velocity does not reflect the overall multi-day journey progress called sustained sledging velocity. See Figure 5.1.
- [*sic*2] No temperature record is available for the Captain Scott party on Mar. 11th, 1912.
- [*sic*3] I find Sir Ranulph's comment/comparison that Captain Lawrence E. G. Oates was "more burdensome than the thirty-five pounds of rock samples, for they did not use up provisions nor cause hours of delay" extremely disrespectful and counterfactual. However, by ignoring Sir Ranulph's disgraceful comparison, one observes that although the specimens "did not use up provisions" the party had to drag the extra weight and use extra calories in doing so, or did Sir Ranulph support Cherry-Garrard's notion that the dead weight does not matter, which stands against all field and theoretical evidence?
- [*sic*4] See above.
- [*sic*5] Lt Bowers did not decide to discontinue recording temperature, since he broke the minimum temperature thermometer on Mar. 10th, 1912.[37] From this day on, temporary temperature measurements are available from Captain Scott's personal thermometer.

By looking at Sir Ranulph's book from the point of view my *cæteris paribus* assumption that the only variable was the weather, one readily notices that he puts emphasis on the weather as being the final cause of Captain Scott and his party's deaths. Unquestionably, Sir Ranulph is under Dr Solomon's spell. He repeats and adds his own counterfactuals without the slightest concern, and without checking her fallacious observations as shown in my previous chapter. Here is how Sir Ranulph compiles his own fallacious findings with Dr Solomon's lies, and provides the genesis for Megan Lane's ridiculous statement[38]

> Scott's original 144-day plan was based on a meticulous [*sic*] weather chart [*sic*] compiled by expert meteorologist [*sic*] George Simpson, later the Director of the Meteorological Office [*sic*] in the United Kingdom. Dr Solomon

> stated that Simpson's estimate of the behaviour [*sic*] of the Barrier weather was "stunning in its accuracy". [*sic*]

It is indeed surprising to find that a man like Sir Ranulph, who has travelling experience in polar regions, could say and *suggest* that Captain Scott's plan to reach the South Pole was based on "meticulous weather charts" or just weather charts. Such a chart never existed, and as I have shown in Chapters 3 and 4, at planning time in 1911 the temperature data for the Barrier was absolutely sparse and not sufficient for a sensible or "meticulous" analysis. Whatever extreme or excessive care was applied by Dr Simpson, it could not compensate for the extreme shortage of weather data. Besides, even today, to predict the weather for an entire 144-days journey is simply an impossible task, regardless of computing power or someone's ingenuity.

Dr Simpson was a meteorologist and even an "expert meteorologist". However, contrary to Sir Ranulph's implication, he was not an expert in Antarctica's meteorology at the "planning time" in 1911. Additionally, his later tenure as a Director of the Meteorological Office has nothing to do with weather planning during Captain Scott's expedition. He, as well as most of the *Terra Nova Expedition* mates, had been in Antarctica for only several months. Does Sir Ranulph suggest that during this time Dr Simpson became an expert in Antarctica's meteorology? And of course, we already know from the previous chapters how "stunning" the accuracy of Drs Simpson's and Solomon's analyses were.

Within the same account, he continues to argue[39]

> Charles Wright, who worked under George Simpson at Cape Evans, wrote that Scott's group had been anticipating warmer temperatures as they descendent the glacier. He was certain that the unexpected cold weather was the main reason for their death and he pointed out that Simpson's report (in 1926) confirmed that nobody have foreseen such weather at that season.

In section 2.3, I have already scrutinized various accounts of the weather during the South Pole journey by the fellow members of the *Terra Nova Expedition*. In between I discussed Wright's analysis. The reader may find more on Silas' analysis in section 2.3. In here, I only note that Wright, contrary to Sir Ranulph's assertion, was supporting the opinion that "this sudden drop in temperature is [un]likely to be unusual, and my belief is in that this may be a regular annual change".[40]

An additional notion produced by Sir Ranulph in the above account is related to his unsubstantiated claim that Dr Simpson during his Halley Lecture delivered on May 17th, 1923[41] "confirmed that nobody have foreseen such weather at that season". In Chapter 3, I have analyzed all aspects of Dr Simpson's analysis of Captain Scott's journey from a meteorological point of view. Dr Simpson did not confirm anything during his lecture. He did not have enough data and did not have good scientific methods to examine Captain Scott's record. He, at best, could only make certain unconfirmed claims not supported by scientific insight. Besides, the question remains open of how Dr Simpson (or anybody else) could confirm that nobody would have "foreseen"!

Evidently, Sir Ranulph, while writing the above account, also forgot about Dr Solomon's false motives that "George Simpson, Scott's meteorologist, was convinced that the weather was highly unusual, but he couldn't prove it and I could [*sic*]. That's when I knew I had to write this book."[42]

Indeed, from Sir Ranulph's writing it is difficult to figure out who found what and who proved something. The causality of events is confused. The essence of his tantamount of weather with climate analysis is present in his appreciation of Dr Simpson's work.

From one side, Sir Ranulph tells the reader that the weather event like the *Extreme Cold Snap* could not be predicted (foreseen) by Dr Simpson, or anyone I presume. From the other side, Sir Ranulph informs the reader that Captain Scott's plan of his 144-days journey was based on Dr Simpson's weather chart of stunning accuracy. I presume that a good number of readers were confused by these contradictory notions. It is quite possible that even the author of these statements was entirely confusing the issue of weather and climate. In Chapter 4, I described Dr Solomon's fallacious analysis of weather and climate. Here in the case of Sir Ranulph's account, it is evident that he also formulates a fallacious confusion of weather and climate. Finally, he summarizes his thesis[43]

> He [Captain Scott] identified instead a series of unpredictable [*sic*] mishaps, the chief of which was the freak weather that defined [*sic*] Simpson's meticulously worked predictions [*sic*].

and supports it by using Dr Solomon's "discovery"[44]

> The new meteorological records demonstrate unarguably [*sic*] why Scott could not in 1912 have foreseen such exceptional weather.

Thus according to Sir Ranulph, Captain Scott was finished off by the freak weather which not only defied Dr Simpson's "meticulous predictions," but which also could have been foreseen by Captain Scott. This conclusion begs a funny question: what would Captain Scott *do* if he, at the planning stages, predicted the Four Days Blizzard, the *Extreme Cold Snap*, and the *Never Ending Gale*? Indeed, this question ridicules Sir Ranulph's fallacious thinking and arguments. Would Captain Scott not follow Lt Shackleton's route to the South Pole so as to not encounter the Four Day's Blizzard at the foot of Beardmore Glacier? Presumably, and according to Sir Ranulph's suggestion, Captain Scott would turn to another route, but which one? The selection of a new route would be easy. Just turn to Dr Simpson's "meticulous weather chart," and it would provide Captain Scott with another "estimate of the behavior of the Barrier weather" and a new route to the South Pole accompanied with nice and pleasant weather.

Right at the beginning of his book titled *Captain Scott*, Sir Ranulph informs the readers that "I do not in any way identify with Scott". It, as every personal declaration, may or may not be true, but what is certain from the above subsection is that Sir Ranulph, like Captain Scott and many others, are telling half-truths or simple lies, which usually take the form of exaggerations related to his and/or Captain Scott's expeditions. Indeed, it is a common feature of explorers. And based on his accidental admission of Captain Scott as one of his heroes, I do not think that Sir Ranulph is telling the truth when he states that he does not identify with Captain Scott.

Before we leave this book behind, one more telling example of Sir Ranulph's pushing of the facts and data to prove his belief can be found in his description of Captain Amundsen's abortive September 1911 journey[45]

> Only a week later, after sledging at temperatures down to –56° C, he [Amundsen] was back at his base with his men in disarray, with serious damage to the feet of both men and dogs and accusations against him of cowardice. Five dogs had frozen to death … Amundsen quelled his mutiny by banishing the two main troublemakers from his Pole team. Scott was never to suffer from such an internal revolt for three reasons: his selection of personnel; the expedition's basic framework of discipline, which even his non-naval scientists understood; and, mainly, because he never subjected his men or his animals to such plainly foolhardy travel. Wilson had been allowed his winter journey[*sic*] and Teddy Evans had asked to travel on the barrier (at the same time as Amundsen's fiasco) but only for a distance of about fifty miles and hence of very limited real risk.[*sic*]

When Sir Ranulph judged Captain Amundsen's risk taking, he used the criterion of time of departure. Yet when Captain Scott took a similar risk in letting Lt Evans go out at the same time of year, Sir Ranulph switched the criterion to distance covered in order to exonerate Captain Scott! As a result, he disrespectfully downplayed the *Cape Crozier Journey* and Lt Evans' September 1911 journey. Lt Evans' view of his journey can be best summed up in a speech he gave on Nov. 4th, 1936 – by then Admiral Sir E. R. G. R. Evans – at the Royal Navy Hospital, Chatham. Alongside a mention of his disturbing interest in nocturnal emissions during polar expeditions, he stated[46]

> I have been so cold during a winter sledge journey, when the temperature was 73° below zero, that I have wished for death. However, a cup of hot tea makes a great difference and seems to run right down to one's toes.

Given his own experience, I think that if he was alive today, Evans would have some sharp words for Sir Ranulph about his downplaying Evans' suffering for his own agenda.

⋮

In late 2013, Sir Ranulph's book titled *Cold: Extreme Adventures at the Lowest Temperatures on Earth*[47] came to the bookstores. A small part of it is devoted to Captain Scott's *Terra Nova Expedition* and more particularly to his *South Pole Journey*.[48] This short narrative shows what Captain Scott and Sir Ranulph Fiennes have in common: lack of attention to details, which leads to dangerous or even catastrophic events. Our Western society often permits its peoples to act casually, as the margin of safety over our lives is wide. However, taking this Western notion without critical scrutiny of its origin into an entirely different culture or place fundamentally jeopardizes its applicability. That was exemplified in the case of Captain Scott (see Chapter 12), who took the British utilitarian notion and applied it in the British context in the entirely different milieu of Antarctica.

To the investigative reader of the previous Chapter 4, Sir Ranulph's new account must appear as intellectual bombshell[49]

> Susan Solomon, an American atmospheric scientist [*sic*1] with fourteen years' experience [*sic*2] of studying Antarctic [*sic*3] weather patterns, has written a book in which she compares the known weather data of 1912 with auto-

> mated met-records meticulously collected from weather stations all along Scott's Barrier route between 1950 and 2000 [*sic*4]. This data can now be accessed, through the Internet Archive, at the University of Wisconsin-Madison. It shows with cold, hard data [*sic*5] that rogue weather played havoc with Scott's group, whilst Amundsen had, by sheer luck, chosen a route to the South Pole which the Gods smiled upon and experience fine Antarctic weather out and back [*sic*6].

[*sic*1] Dr Solomon is (was) not an atmospheric scientist. She received education in chemistry and her research concerns atmospheric chemistry,

[*sic*2] Actually, Dr Solomon claims 15 years of studying weather on the Barrier. However, even this is a gross exaggeration, and the investigative reader may consult section 4.2 for more on that,

[*sic*3] It is not true that Dr Solomon was studying "Antarctic weather patterns". She "studied" temperature data from 4 (or 5) weather stations. Since the area of Antarctica is bigger that the US or a good part of Canada, does Sir Ranulph suggest that 4 or 5 weather stations are sufficient to study weather patterns over these countries?

[*sic*4] It is not true (see Chapter 4). The actual period was 1986–1999, with a few missing years.

[*sic*5] Any "cold, hard data" or even junk data show nothing, unless a scientific method is used to analyze these data and arrive at certain conclusions,

[*sic*6] This comment about trollish Gods looking after Captain Amundsen belongs to the general category of the marvelous fibs and flip-flops of Sir Ranulph Fiennes. I wonder how he accessed the Gods' server with archives of "cold, hard data" to formulate after suitable analysis his conclusion that Captain Amundsen was sledging in "fine weather" conditions. The Gods' server must be loaded with zillions of yottabytes[50] of weather data from Antarctica, including data related to Captain Scott. Oh, if I could have all of it. I have to e-mail Sir Ranulph, seriously!

But, I would not only ask about the above. I would ask also Sir Ranulph why my scientific analysis of the weather and its role in Captain Scott and his companions' deaths, published as a preprint[51] in 2010 and later in condensed form in a peer-reviewed scholarly journal[52] in 2011 did not find its way into his one-sided account of Captain Scott. (see Chapters 7 and 8).

Ultimately, Sir Ranulph's actions are best described by George Orwell in his essay *Notes on Nationalism*[53]

> Every nationalist is haunted by the belief that the past can be altered. He spends part of his time in a fantasy world in which things happen as they should – in which, for example, the Spanish Armada was a success or the Russian Revolution was crushed in 1918 – and he will transfer fragments of this world to the history books whenever possible. Much of the propagandist writing of our time amounts to plain forgery. Material facts are suppressed, dates altered, quotations removed from their context and doctored so as to change their meaning. Events which it is felt ought not to have happened are left unmentioned and ultimately denied.

5.3. Barczewski, Jones, Crane, and Murray

Shortly after Sir Ranulph's book, books on different aspects of Captain Scott by Dr Max Jones[54] and Dr Stephanie L. Barczewski[55] followed. Dr Jones and Dr Barczewski are university-trained historians, currently employed at the University of Manchester and Clarkson University, respectively. The hope was that university-trained historians would use scientific methods to scrutinize Captain Scott's life and his expeditions. Unfortunately, their efforts went short, very short, and were limited to recycling otherwise well-known historical material. With regard to the relationship of Captain Scott South Pole journey and its meteorology, both authors felt obliged to remark on Dr Solomon's "discovery" and they took for granted Dr Solomon's revelations. This is highly surprising, since the basic elements of the historical method were entirely ignored and historical reasoning not used. How is it possible that two historians, after reading Dr Solomon's book, cannot detect her fallacious reasoning? The fallacies of Cherry Picking and Gambler's fallacy should be immediately detected by trained historians.

None of that happened, and Dr Barczewski not only embraced Dr Solomon's work as a contribution "from the scientific community"[56] but also added several counterfactuals. We have seen in the previous chapter how little of scientific worth was presented in Dr Solomon's publications and lectures. Dr Barczewski is even more eager than Dr Solomon to dramatize (drag) weather accounts of Captain Scott's South Pole journey. She notices, like Dr Solomon before her, that late February and March 1912 was particularly cold, but she adds that "the weather was indeed unusually cold in the winter of 1911–12".[57] Dr Barczewski's suggestion is not true on two counts. She is not specifying where and how the temperatures in 1911–12 differed from recorded ones at different times. As far as the Cape Evans record is concerned, we know from Figs. 3.15–3.17 that nothing "unusual" was observed in temperature changes during 1911–12. Therefore, Dr Barczewski's observation remains a historical riddle, and making plots of temperature data does not belong to the history department.

Even thought Dr Barczewski spends a short time on discussing issues pertinent to Captain Scott's weather, she produces an extra fallacy by saying that[58]

> Normal minimum temperatures [*sic*] on the Barrier in late February and March range between –10 and –30 degrees Fahrenheit, whereas Scott and his man were consistently recording temperatures of –35 to –45 degrees Fahrenheit.[119]"

Dr Barczewski's lack of precision is astonishing. What are, according to her, normal minimum temperatures on the Barrier? Does the location on the Barrier matter? From where did Dr Barczewski infer the "range between –10 and –30 degrees Fahrenheit"? It is wild guessing by her to promote Captain Scott's suffering due to much lower temperatures of "… –35 to –45 degrees Fahrenheit". On Fig. 5.3, I have depicted all minimum near surface temperatures recorded by the Schwerdtfeger automated weather station in late February and March. From this figure, one can easily notice that minimum near surface temperatures at the Schwerdtfeger weather station are fluctuating in the wide range of +15°F through to –50°F. Roughly half of these minimum temperature data are located out of Dr Barczewski's "normal minimum temperatures" window. Is she suggesting that these extremes are not normal temperatures? Or is she suggesting that

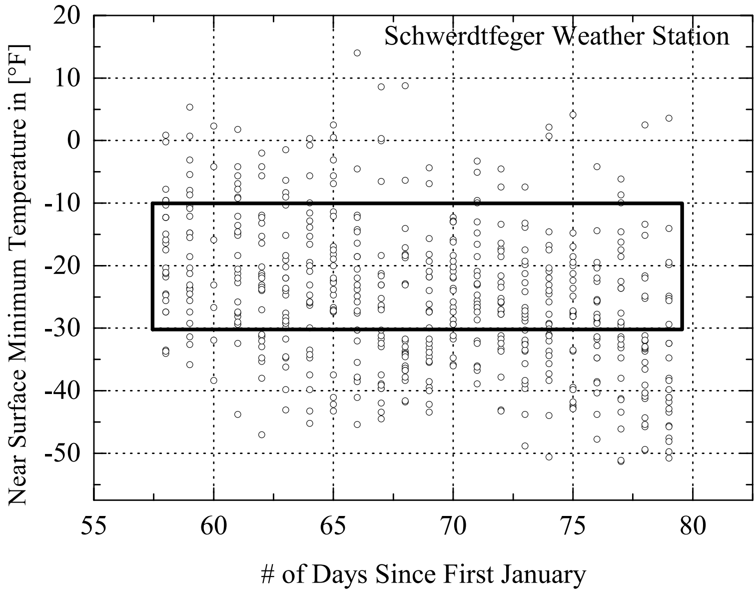


Figure 5.3. Near surface, minimum temperatures in [°F] recorded at Schwerdtfeger weather station (One Ton Depôt) in for Feb. 27th through Mar. 19th and 1985–2012. The "Normal minimum temperatures" suggested by Dr Barczewski are indicated by the rectangular window.

half of the temperatures recorded at the Schwerdtfeger weather station – thus in nearest proximity of One Ton Depôt – are not normal? Why is Dr Barczewski suggesting that Captain Scott should encounter "normal" temperatures?

Similar to her predecessors, Dr Barczewski adds small exaggerations here and there. For example, in referring to Cherry-Garrard, who after returning from his First Rescue Party trip apparently according to Dr Barczewski told Tryggve Gran that[59]

> As soon as sun went down, the temperature would at once sink to –50 degrees C [*sic*]

The "degrees C" scale was added in the English edition of Tryggve Gran's book, which was the Norwegian customary temperature scale.

In the Fahrenheit scale, which was in customary British usage at that time, it would mean that Cherry-Garrard said "–58°F". Consulting the original Norwegian edition of Tryggve Gran's book, I find in the entry of Apr. 18th – the day when he was told by Cherry-Garrard – no specification of temperature scale is present only "–50".

But then what did Cherry-Garrard tell to Gran? Surely he was thinking in Fahrenheit scale. Did he say "–46 degrees" which gives about –50°C, or did he say "–50 degrees" which gives –46°C? It is inconceivable that Cherry-Garrard used the Celsius scale. Therefore, the line cited by Dr Barczewski should read

> As soon as sun went down, the temperature would at once sink to –50 degrees F(–46°C).

Indeed, not a big difference, nevertheless a small overstatement is present. The real question remains: how Cherry-Garrard measured (estimated) these temperatures when he commented that "Having no minimum thermometer we did not know the night temperatures"?[60] In Table 2.3 (Chapter 2), I presented Cherry-Garrard's Register of his First Relief (Dog Sledge) Party, Feb. 26th through Mar. 16th, 1912. This table is telling. At the time that the party was at One Ton Depôt, the lowest temperature was –37°F, recorded on Mar. 8th at 20:00 hours (NZST), and quite far from the alleged –50°F. However, if Cherry-Garrard could not measure night minimum temperatures, is it possible that he guessed (estimated) these temperatures? Certainly he could have done so. However, it is not true that the minimum daily temperatures occur *only* during the night. Fig. 3.5 explicitly demonstrates that the minimum temperatures were frequently recorded not only during the night hours, but also during the daytime. Therefore, Cherry-Garrard's generalization that temperatures at One Ton Depôt (Schwerdtfeger weather station) are going down as soon as the sun goes down is not true.

Towards the end of Dr Barczewski's lamenting about terrible weather conditions described by Captain Scott in late February and March 1912, she accounts[61]

> The poor surface slowed their pace so much that even their extra food could not compensate. With better conditions, the sledge would have pulled far more easily, and the polar party might well have been able to travel fifteen miles a day [*sic*], which is what they were averaging [*sic*] prior to the onset of the cold snap. At that rate of speed they would have reached One Ton Depot on 4 March. Oates would have still been alive, and Cherry-Garrard would have been waiting for them with the dogs, having arrived the previous night. That joyous reunion, as we well know, never took place.

Here I have to warn the reader never to go for a trip to Antarctica organized by Dr Barczewski. On Feb. 27th that is on the date of the *Extreme Cold Snap* onset, Captain Scott's party was at –82.1 south, and thus at a distance of 2.196 degrees from One Ton Depôt ((–)82.1 – (–)79.904 = 2.196). This distance is equal to about 132 geographical miles, and it would mean that Captain Scott's party would arrive at One Ton Depôt after 9 days – that is on Mar. 6th (not on Mar. 4th), provided that they travelled with Dr Barczewski's velocity of 15 miles per day. However, Dr Barczewski fabricated velocity data (15 miles per day) to show the possibility of "joyous reunion" that "never took place" because of the *Extreme Cold Snap*.

Fig. 5.4 illustrates the daily velocity of the Captain Scott party during the *South Pole Journey*, together with a velocity of 15 miles/day fabricated by Dr Barczewski to show that "the polar party might well have been able to travel fifteen miles a day [*sic*], which is what they were averaging prior to the onset of the cold snap". One can see from this figure that during the whole journey, the velocity of the party rarely exceeded 15 miles/day. The velocities of more than 15 miles/day were achieved during the final stages of the inward Polar Plateau journey, with the best result of 19.7 miles on Jan. 30th, 1912.

However, Dr Barczewski informs the reader that the Captain Scott party averaged a daily velocity, before the cold snap, of 15 miles per day. This is not true. The reader may consult Fig. 5.1 in the current chapter, where I show that from Feb. 6th through Mar. 9th, 1912, the Captain Scott party travelled with a steady average velocity of $\upsilon = 9.17 \pm 0.07$ miles/day.

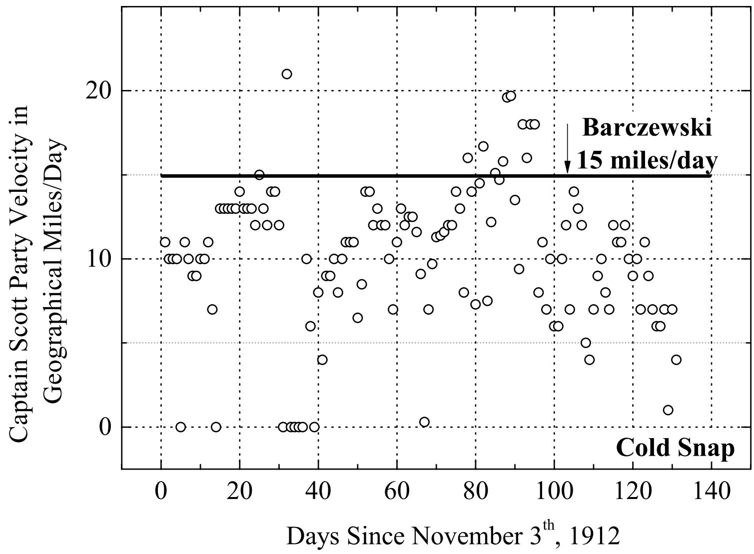


Figure 5.4. The daily velocity of Captain Scott's party during the South Pole journey in geographical miles per day. The velocity of 15 miles/day fabricated by Dr Barczewski is also indicated by a solid thick line.

⋮

Perhaps the most important contribution by Dr Max Jones to understanding Captain Scott's *Terra Nova Expedition* and post-expedition meteorological data falsification was his list of temperature changes introduced in the first edition of journals. I have discussed this issue in detail in section 2.2.

In addition to that, in his own terms Dr Jones battles with the weather issue and Dr Solomon's results. According to Dr Jones[62]

> Solomon argues instead [of scurvy] that unseasonably adverse weather conditions were the primary cause of the disaster. Meteorological data gathered on the Great Ice Barrier since 1983 suggest that Scott's assault on the Pole was fatally hampered by atypical weather conditions on two [*sic*] occasions: first, at the foot of the Beardmore Glacier [*sic*], and second, in the period from late February to mid-March, when temperatures on the Barrier were 38°F lower than temperatures at the expedition's coastal base camp, almost double the usual differential.

Indeed, Dr Jones makes an overstatement and adds his own exaggeration of adverse and "atypical" weather conditions faced by Captain Scott, and allegedly confirmed by modern meteorological data. To my knowledge, at no instance was the Four Days Blizzard reported by Captain Scott at the foot of the Beardmore Glacier questioned or called atypical. It was actually only Captain Scott who, without real justification, complained about this blizzard. I have shown in section 1.4 that the blizzards in Antarctica are self-organized criticality events; therefore no average blizzard

duration can be calculated. Therefore, for the issue of typicality of blizzard events, there are no physical grounds.

In the section called *Explanatory Notes* of Captain Scott's journals edited by himself, he further expounds his understanding of the Four Days Blizzard, Dec. 5^{th} through 8^{th}, 1911[63]

> Such conditions [Four Days Blizzard], caused by a tongue of warm, wet air from the ocean pushing unusually far across the barrier, had not been repeated in eight and fourteen years of observation at two [*sic*] modern weather stations established nearby.

Because no references are given by Dr Jones, it is hard to figure out from where he found the number of years of observations. To my knowledge, and according to the data of the Antarctic Meteorological Research Center and Automatic Weather Station (University of Wisconsin-Madison), at the Barrier there is only one[64] and not two, as suggested by Dr Jones, automated weather stations in the proximity of the foot of the Beardmore Glacier. The station is called *Elaine* (–83.094, 174.285). The Elaine station is about 51 km (31 miles) from Captain Scott's camp during Dec. 5^{th} through 8^{th}, 1912. The additional two automated stations *Lettau* (–82.475, 174.538) and *Eric* (–81.496, 163.947) are at the distances of 137 miles (220 km) and 142 miles (230 km), respectively. Since the station *Eric* was only operational from Jan. 29^{th}, 2005, Dr Jones was perhaps referring to the *Elaine* and *Lettau* stations. However, Dr Jones did not present calculations and did not explain what the blizzards at entirely different geographical locations have to do with the weather recorded by the Captain Scott party.

These are technical aspects of Dr Jones' unscientific comments; however, even more confusing is Dr Jones' logic used in describing the rareness of blizzards lasting say four consecutive days and Dr Solomon's revelations. For Dr Jones, the rareness of a meteorological event is measured by its observational frequency. If the event was not observed at X-named weather station for as he is saying for "fourteen years," then it is indeed a rare event.

Let me recall here Dr Solomon's logic in a somehow simplified manner. She fallaciously argued that if for a given set of modern observations the event of similar proportions occurred at least one time, then it is proof that a similar event occurred in the past during Captain Scott's journey to the South Pole. The occurrence of a temperature event in 1988 proved, according to Dr Solomon, that a similar event in 1912. Dr Jones entirely accepts Dr Solomon's fallacious reasoning and adds his own comment[65]

> Temperatures as cold as those Scott experienced in 1912 have been recorded only once [*sic*] on the Barrier since 1965 [*sic*]. Scott's emphasis on unexpectedly extreme weather as the primary cause of the disaster may after all [*sic*] have been correct.

The funny thing is that Dr Jones does not use the same logic in his judgment of blizzard occurrence. If he used it as in the case of Dr Solomon's "discovery," then because a four days blizzard did not occur at his X-weather station for fourteen years, he should, in order to be consistent, conclude that Captain Scott invented this blizzard and the four days blizzard never occurred! Dr Solomon and Dr Jones' ways are fallacious reasoning and prime examples of Cherry Picking.

However, for Dr Jones the Four Days Blizzard appears to be of lesser significance than the *Extreme Cold Snap*, and he continues[66]

> This unseasonable cold proved fatal in two ways: first, below –20°F sledging conditions become increasingly difficult, as ice takes on the characteristics of sandpaper. Secondly, below –20°F, the possibility of frostbite is massively increased; frostbitten feet crippled first Oates and then Scott in this critical period.

I have discussed the issue of the effect of temperature on friction and sledging in subsection 3.1.2. In that chapter and especially on Fig. 3.8, one can see that the temperature dependence on the kinetic friction coefficient is by its nature nonlinear, and there is no defined threshold like Dr Jones is describing. There is no threshold at Dr Jones' temperature of –20°F. Additionally, the probability of frostbite is at least a two-dimensional issue (besides individual body properties), and depends also upon wind velocity. The National Weather Center (USA) gives the same frostbite time 10 min at wind speed 5 mph in the range of temperatures ⟨–52, –22⟩°F.

Evidently, Dr Jones fell into Dr Solomon's trap of exaggerating available temperature records at the Schwerdtfeger weather station. In the above citation, Dr Jones erroneously tells the reader that "temperatures as cold as those Scott experienced in 1912 have been recorded only once on the Barrier since 1965." This is data fabrication, as the year 1965 stands for temperature data for Scott Base station, which has nothing to do with the Schwerdtfeger (One Ton Depôt) station.

Relying on Dr Solomon, Dr Jones concludes that "Scott's emphasis on unexpectedly extreme weather as the primary cause of the disaster may after all have been correct."[67] This assessment is puzzling. Did anyone have questions about the accuracy of Captain Scott's statements of the *Extreme Cold Snap*? Did Dr Solomon prove that Captain Scott was "correct"?

In addition to that, Dr Jones continues to battle with the weather issue and Dr Solomon's results. According to Dr Jones[68]

> Meteorological data gathered on the Great Ice Barrier since 1983 [*sic*1] suggest [*sic*2] that Scott's assault on the Pole was fatally [*sic*3] hampered by atypical weather conditions on two occasions: first, at the foot of the Beardmore Glacier [*sic*4], and second, in the period from late February to mid-March, when temperatures on the Barrier were 38°F [*sic*5] lower than temperatures at the expedition's coastal base camp, almost double the usual differential [*sic*6]. This unseasonable cold proved fatal in two ways: first, below –20°F sledging conditions become increasingly difficult, as ice takes on the characteristics of sandpaper. Secondly, below – 20°F, the possibility of frostbite is massively increased [*sic*7]; frostbitten feet crippled first Oates and then Scott in this critical period. Temperatures as cold as those Scott experienced in 1912 have been recorded only once on the Barrier since 1965 [*sic*8]. Scott's emphasis on unexpectedly extreme weather as the primary cause of the disaster may after all [*sic*9] have been correct.

Dr Jones' above account of Dr Solomon's "results" is a cluster of confusing counterfactuals with the pretence of understanding the commented issues. Let me briefly comment on some particularities:

[*sic*1] – the source of this figure is unknown,

[*sic*2] – it is unscientific to say that the data "suggest". Scientific analysis of data using certain scientific methods enables one to draw certain inferences based on certain criterions and assumptions,

[*sic*3] – this is an unfounded exaggeration to say that the Four Days Blizzard "fatally" influenced Captain Scott (see subsection 11.1.6),

[*sic*5] – without stating what temperatures measurements (see subsection 3.1.1) the author is talking about, this is an unscientific and unfounded comment,

[*sic*6] – "differential" means many things but not what the author intended: difference or gradient,

[*sic*7] – it is not true that below –20°F the possibility of frostbite is massively increased. One should remember about windchill factor (see section 5.2),

[*sic*8] – it is data exaggeration by Dr Jones to impose on the reader that he makes reference to climatological data instead of a short and not complete weather record. The actual period was 1986–1999 with 6 (4 years for Elaine + 2 years for Schwerdtfeger) years of incomplete or missing data,

[*sic*9] – it is the most surprising comment, indeed. What does Dr Jones mean by "the primary cause of the disaster may after all have been correct". Captain Scott told us in his *Message to the Public* that extreme weather during the Barrier return leg was the principal cause of the disaster. Did Dr Jones or anyone before question Captain Scott's weather account and record?

⋮

In late 2006, David Crane in *Scott of the Antarctic: A Life of Courage and Tragedy*[69] entered the list of authors who struggled with understanding Captain Scott's work and personality. Right from the start, on page 11, Crane pondered over tough and vital questions[70]

> How has a life that was once seen as a long struggle of duty been transformed into the embodiment of self-interested calculation? How has the name of the meticulous and "cautious explorer" his men followed become synonymous with reckless waste? How has the son and husband his mother and wife described become the type of English emotional inadequacy? By what process does a tenderness for animal life become a pathological disorder that belongs to the psychology of military incompetence? What is it that stops a whole age hearing in the cadences, the measure and the sentiment of Scott's last harrowing appeal to the public, the words of the dying Hamlet?

Given Captain Scott's exploration work, dramatic structure and depth of characterization, the *Last Expedition* can be analyzed, interpreted and argued about from many perspectives: social, political, technological, psychoanalytical. Crane took his argument over all of these possible standpoints, and some five-hundred pages later arrives at a startling conclusion[71]

> "It was not faulty logistics that did for Scott, not lack of food or fuel, not washers, not Meares taking more than his share, not imprecise instructions, not over-rigid instructions, not arrogance, not stupidity, not the fifth man, not scurry, but the weather."

Several lines later, Crane rephrases his conclusion and observes, “they had been, quite literally, killed by the cold – a one in ten chance, Simpson conservatively estimated”.[72] For a brief explanation of why this statement by Dr Simpson was never said by him, see section 4.1. Although it is not clearly marked in the book,[73] in the last chapter called *Epilogue*, Crane intertwines his own observations with “The most original work done in recent times on Scott’s last expedition is Susan Solomon’s *The Coldest March*, and the meteorological details in this chapter are based on her findings”. It is a very unfortunate epilogue for Crane’s book which despite my criticisms in subsection 10.5.2 is still, “the first biography to take an equal measure of all parts of its subject’s life”.[74]

⋮

The final considered work concerning Captain Scott was a PhD thesis was written by Carl Murray at the Institute of Antarctica and Southern Ocean Studies, the University of Tasmania. His work is freely available from the University of Tasmania’s internet site.[75]

Murray’s work, contrary to his declaration does not present any new results, but only redundant and selective recirculation of facts presented by the authors before. His agenda is “to restore some balance to one part of the long record of adulation of Amundsen and denigration of Scott. But instead of relying on supposition or personal preference, the argument is based on Amundsen’s own evidence”.[76]

However, Murray’s arguments fell short as he presented – to use his own words – dubious reasoning and cheap shots.[77] I will not go into these in detail, but a good idea of what they consist of can be found in Sarah Wilks’ demolition of one of his papers that he published in Polar Record[78]

> … he [Amundsen] is demonstrating his understanding of what makes the Eskimo dogs “tick” (while perhaps demonstrating an incomplete understanding of more domesticated dogs). This passage alone indicates that Murray’s depiction of Amundsen as a person who had no empathy with the dogs is not defensible.
>
> Later in the article, Murray refers to dogs being repeatedly flogged and physically punished, although this imputes a tenor to Amundsen’s book that does not exist. Indeed, reference to the original text quoted by Murray to make this “point” (Amundsen 1976, II: p. 16) shows that on the occasion cited, Amundsen was trying to restore order after one dog (Hai) snatched another dog’s (Rap) rations. Amundsen intervened immediately …
>
> Amundsen’s decision to roll around fighting in the snow to retrieve a piece of food from the sharp teeth of a semi-wild dog rather than just giving Rap another portion (the party was well supplied at that point) illustrates two things: the pack mentality of the dogs (do anything you can get away with to a weaker individual while respecting those who are stronger) and Amundsen’s understanding that he had to intervene because had the thief got away with it, then that dog would have challenged other dogs and Amundsen in the future.
>
> It is instructive to compare this instance of Amundsen physically punishing a dog with an incident related by Scott during the Discovery expedition. One day, the dog pack turned upon a particular individual and “murdered” the dog. While Scott was waiting for a break in the weather to get “… these bloodthirsty wretches chained up …” there was another attack

> and "… another poor beast lay mangled on the ice-foot." Scott described his course of action the next day: "… one by one, they were led out and severely chastised in front of their victims" (Scott 1905, p. 190). It is of course entirely pointless and potentially cruel to attempt to discipline a dog the day after it has committed a transgression and Scott himself was aware that the dogs didn't understand why they were being whipped: "… the dogs evidently didn't know what it was all about …" However, Scott continued beating the animals anyway because: "… the punishment helped to relieve our righteous indignation …" (Scott 1905, p. 191).
>
> Comparing Scott's and Amundsen's reactions to disorder in the ranks of the dogs, it is not hard to see which of the two men had the greater understanding of the animals, and which of the two was engaging in unthinking cruelty …
>
> As Serpell (2009) and others have pointed out, people culturally accustomed to treating dogs as family members may find the killing and consumption of dogs repugnant. It is thus tempting to dismiss Murray's outrage that Amundsen planned his expedition in such a way as to "use up" his dogs as a manifestation of contemporary Westernized attitudes towards "food" and "non-food" animals (although analogous outrage on behalf of Scott's ponies is lacking). However, as demonstrated by the discussion above, and reading this in mind of Murray's stated aim (i.e., to "restore some balance to one part of the long record of adulation of Amundsen and denigration of Scott"), it is clear that Murray is prosecuting war on Amundsen in the tradition of past hagiographic [*sic*] efforts. Murray's thesis, at least with respect to Amundsen's "troubled and contradictory attitudes towards his animals," is not defensible. While Amundsen did take a very utilitarian view of the dogs, as essential tools for use in the achievement of his goal, he generally took extremely good care of these tools. Whatever Amundsen's other personal failings, there is no evidence of general callousness and cruelty of the sort inferred by Murray on Amundsen's expedition. Neither is there any evidence that Amundsen as expedition leader and manager tolerated the sort of acts of animal cruelty by omission, carelessness, or ignorance that characterized Scott's expeditions, some of which have been described above. One suspects that besides his original sin of beating Scott to the South Pole, what Amundsen has really done wrong here is to offend modern sensibilities with respect to "food" species: yet as has been noted, what is an acceptable "food" or "non-food" species can vary with culture, time, and place.

Leaving all of that behind, what is most surprising is his observation that "meteorologist Susan Solomon would authoritatively vindicate"[79] Captain Scott's claim in the *Message to the Public* that "no one in the world would have expected the temperature and surface which we encountered at this time of the year." Was there a need to vindicate (prove correct) Captain Scott's record inparticular? Did anyone in the past question the integrity of Captain Scott's records?

From the previous chapters, we know that not one member of the expedition and subsequent authors writing on Captain Scott was openly (in writing) questioning Captain Scott's weather records. Therefore, Murray formulated a counterfactual thesis and attempted to prove it by using fallacious appeals to Dr Solomon's authority.

Murray, in the most personally satisfying way to end a historical dispute (analysis), was devising and/or promoting a false presupposition(s) that underlined all the puzzles it involved. He falsely claimed[80]

> An article in the *Proceedings of the National Academy of Science* in 1999 by US meteorologists Susan Solomon and Charles R. Stearns was an important first step in rescuing the commentary from the realm of private, novelistic speculation where it had been languishing, and introducing new empirical evidence. The authors showed that fifteen years of data from automated weather stations vindicated Scott's claim that the weather conditions which confronted the polar party were exceptional. Solomon and Stearns noted that statements by the expedition leader and his meteorologist about these extraordinarily low temperatures in March 1912 had been "largely ignored" or "explicitly dismissed" (13012), but attested that "Scott was correct rather than petulant when in his final message to the public he wrote, '… no one in the world would have expected the temperatures … which we encountered at this time of the year'" (13015).

The numbers in parentheses in the above citation refer to specific pages in Drs Solomon and Stearns' PNAS paper. Are these comments accurate? Of course, as an author with a clear agenda, he is not being accurate. Drs Solomon and Stearns wrote: "Remarkably, Scott's and Simpson's statements regarding the temperatures in March of 1912 have been largely ignored. A few authors explicitly dismissed suggestions [*sic*] of severe weather (8), perhaps because such conditions were assumed to be typical for the harsh climate of Antarctica."

The above comment is incorrect on two counts. In it, reference (8) refers to the book (not "authors") of Silas Wright, which I have reviewed in section 2.3. I have shown there that at no point was Silas "dismissing suggestions of severe weather". On the contrary, Silas had presented a thorough though flawed analysis. I have shown in Chapter 4 that the second mistake in Dr Solomon's comment is that Captain Scott's and Dr Simpson's statements related to weather in March 1912 were ignored. The issue of weather during the final march was widely discussed by many members of the *Terra Nova Expedition*.

Thus, we have a propagating chain of inaccurate statements borrowed from one author by another author. At each instance, the purpose of the mistake was different. Dr Solomon used her lies as a justification for research presented in her fallacious paper (see section 4.1). Murray presented his account to change the paradigm through his analysis of Captain Scott's expedition from "private, novelistic speculation" to a scientific investigation, which *per se* is more trustworthy.

To close his argument on the issue, Carl Murray observes that "as Solomon demonstrates, sciences like meteorology and physiology [*sic*] have brought a better understanding of the actual conditions Scott faced, thus removing certain topics from the realm of mere speculation".[81] Although Dr Solomon did not perform physiological analysis of Captain Scott's expedition, I only accept Murray's appeal to sciences as a false premise. It is false in a similar way to Cherry-Garrard's empty appraisal of science.[82] Yet Cherry-Garrard did not find the motivation and time to learn, and more importantly use, basic navigation skills including marching according to a compass needle.

Dr Murray's appraisals of Dr Solomon's weather related work and his ability to find and cite her most unfounded lies are beyond belief[83]

> she [Solomon] found to her surprise [*sic*] that "Scott and his team had analyzed the meteorology in exquisite detail, in a manner that can only inspire the greatest admiration by scientist [*sic*] and nonscientist alike" (xvii). Furthermore, she argues that "more than one myth of Scott as a bungler crumbles" in the light of the knowledge supplied by the modern disciplines of "sea ice dynamics, nutrition, snow physics, materials science and human physiology." Her thesis, in short, is that "Scott and his men did everything right regarding the weather but were exceedingly unlucky"

I wonder how these scientific disciplines helped Drs Solomon and Murray to figure out the relationship between Captain Scott and sea ice dynamics, snow physics, and say materials science. I sense that Dr Murray is implying that although it was not directly observed, Captain Scott due to his hidden (tacit?) sense of laws of nature applied modern methods and knowledge to his exploits. However, one hundred years ago there was no need and justification to be especially scientific in regard to Antarctica's weather, and do "everything right" about it. Just common sense in distinguishing what the weather and climate would do. And today, there is no requirement to be especially scientific about Antarctica's weather.

5.4. Synopsis

In this chapter, I examined the post *Terra Nova Expedition* accounts of its meteorological records by outside authors. A very grim picture has emerged, and careless references to temperature records of the Captain Scott party were shown. I have not pointed out all errors, misquotations, and misinterpretations, but I have pointed out the major ones. My purpose was to show that Captain Scott's expedition was about the numbers expressed in measuring distance, time, speed, temperature, rations, *et cetera*. In modern usage, the expedition was primarily about logistics. Someone's high spirits and morale causing them to confuse temperature scales, mileage, direction, and food rations in Antarctica would be a deadly business.

It is telling that academically trained historians (Drs Jones and Barczewski), holding high faculty positions at respectable universities, took Dr Solomon's revelations without critical re-examination. I am not speaking here about the examination of Dr Solomon's revelations with methods which will be presented later in this book. These methods are certainly beyond their education. I am speaking about simple common sense analyses presented in this chapter. Is the Cherry Picking fallacy too difficult for historians to spot? And these "historians" are teaching students.

The elementary scientific methodology and obligation of re-examining (retesting) other scholars' results was ignored, and Dr Solomon's thesis was embraced as pleasurable news. I wonder how the development of physics would look like without constant scrutiny. Would say cold fusion became a reality?[84] Did Captain Scott think about the possibility of a Hollow Earth with openings at the poles,[85] when on Jan. 13th, 1912, at a distance of about 69 miles from the Pole he noticed "It looks as though we were descending slightly"? Was Captain Amundsen expecting to find the entrance

to Hollow Earth, when on the way to the South Pole he observed "Our altitude came out at 9,475 feet above the sea, or a drop of 825 feet in the course of the day. This surprised me greatly. What did it mean? Instead of rising gradually, we were going slowly down. Something extraordinary must await us farther on, but what? According to dead reckoning our latitude, that evening was 86°S."[86] But nothing was there, only the endless and featureless Antarctic Plateau. In a way, nature provided Ockham's razor to Captain Scott's and Captain Amundsen's thinking, and a simple rationale to their journeys.

Chapter 6

Meteorological Data and Weather Forecasting

My mind rebels at stagnation. Give me problems, give me work, give me the most abstruse cryptogram, or the most intricate analysis, and I am in my own proper atmosphere. I can dispense then with artificial stimulants. But I abhor the dull routine of existence. I crave for mental exaltation.

Sir Arthur Ignatius Conan Doyle[1]

"This is indeed a mystery," I remarked. "What do you imagine that it means?" "I have no data yet. It is a capital mistake to theorize before one has data. Insensibly one begins to twist facts to suit theories, instead of theories to suit facts."

Sir Arthur Ignatius Conan Doyle[2]

Throughout the previous chapters, I have been dealing in various ways with meteorological data, both historical and modern. Due to this book's organization I have not yet discussed, but have sporadically mentioned, the fundamentally important issue of meteorological data acquisition. The current chapter is divided into two sub-chapters. In the first sub-chapter, denoted from 6.1 through 6.4, I will present and comment on all pertinent procedures of data collection, precision of data collection, and statistical analysis of historical and modern data for the Ross Ice Shelf and Ross Island, as well as for manned and automated weather stations. The reading of these sub-chapters is not essential for understanding the following chapters, and the reader may skip it or consult it as needed. However, one should bear in mind the importance of sections 6.1 through 6.4, as understanding and examination of data and the question of methods is fundamentally important in the subsequent scientific data analysis.

In the following chapters, I will be concerned with two meteorological variables: near surface air temperatures and near surface wind velocities. Therefore, I will limit current descriptions to temperature and wind velocity measurements.

More important, as far as the forthcoming analysis of the *Extreme Cold Snap – February 27th through March 27th, 1912* in Chapter 7 is concerned, is section 6.5, in which I present an outline of the artificial neural network's forecasting of time series. In the case under consideration, I will use a back-propagation artificial neural network to *retrodict* Captain Scott's temperature data reported by his party in late February through to March 1912. Here, I use the word ***retrodict*** in its conventional meaning, as the opposite of predict. My approach to finding the actual air temperatures during the Captain Scott party's march on the Barrier back in 1912 will consist

of two components. The first component will consist of finding and training the appropriate artificial neural network to *retrodict* temperatures on the Barrier based on temperatures recorded at Ross Island's McMurdo Station. In the second step, using the artificial neural network and the Cape Evans 1912 temperature record, I will *retrodict* the expected temperatures at the approximate locations of the Captain Scott party in Feb. 27th through to Mar. 27th.

Section 6.5 is not meant as an in-depth account of artificial neural networks, but rather as a layman's account of the method which will be used in the next chapter to analyze Captain Scott's meteorological record.

6.1. Sources of Meteorological Data

In this book I have used historical meteorological data of the following expeditions:

- The *Discovery Expedition* (1901–1904) under then Commander Scott's command,
- The *Nimrod Expedition* (1907–1909) under Lt Shackleton's command,
- The *Terra Nova Expedition* (1909–1913) under Captain Scott's command,
- The *Fram Expedition* (1909–1912) under Captain Amundsen's command.

Obviously, since I am mostly concerned with Captain Scott's *Terra Nova Expedition*, the data of remaining expeditions have been used infrequently. The meteorological historical data used in the book is:

- Daily near surface temperature data recorded at Hut Point, Cape Evans, Cape Royds, *Framheim*, and various locations during sledging journeys,
- Daily near surface minimum temperature data at the above-mentioned locations,
- Near surface wind velocity data at Cape Evans and Hut Point.

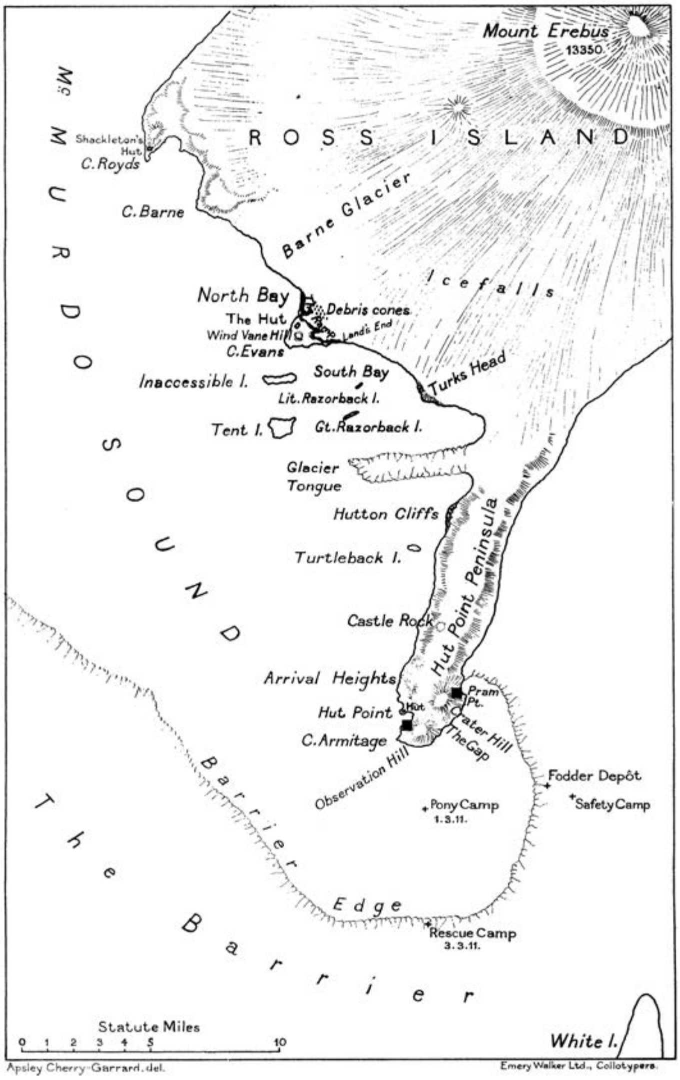
In the case of modern meteorological data, I used the respective data recorded at manned and automated weather stations (AWS) respectively:

- McMurdo Station,
- Scott Base Station,
- Amundsen-Scott South Pole Station,
- Schwerdtfeger AWS,
- Elaine AWS.

6.1.1. The Ross Island Historical Weather Stations

In this book, I have used both historical and modern daily near surface minimum temperature data. The historical meteorological data was collected by the *British Antarctic Expedition* (1910–1913), also known as the *Terra Nova Expedition*, at various locations at Ross Island and at the Ross Ice Shelf.

Fig. 6.1 illustrates the approximate locations of stationary weather stations at the Western coast of Ross Island, which is separated from the mainland by the McMurdo



McMURDO SOUND

Figure 6.1. A map of southern McMurdo Sound and Ross Island. Captain Scott's *Terra Nova Expedition* hut at Cape Evans and the *Discovery Expedition* hut at Hut Point are clearly indicated. At these sites, meteorological observations were taken during the *Terra Nova Expedition*. The modern meteorological observations are taken at the American operated McMurdo Station and New Zealand operated Scott Base located at Pram Point. Both stations are marked by a black square, ■. In the upper left corner, Lt Shackleton's hut at Cape Royds is also depicted. The map is taken from Cherry-Garrard's Vol. I, *cf*, p. 194–195. Google Maps also provide more insight. The scale of the map is in statute miles: 1 statute mile = 0.868976 geographical miles.

Sound area. Originally, during the *Terra Nova Expedition*, Captain Scott planned to land at Cape Crozier's "mainly volcanic tuff" on the North-West coast of Ross Island. However, the landing proved impossible. The second option was the old *Discovery Expedition* base at Hut Point. The landing also proved impossible. Captain Scott's "main wish was to choose a place that would not be easily cut off from the Barrier".[3] Finally, the decision was taken to land on a small cape called "the Skuary," which Captain Scott upon landing "rechristened Cape Evans in honor of our excellent second in command [Lt Edward R. G. R. Evans]".[4] Today, thanks to the United States Antarctic Program, one can watch Captain Scott's hut at Cape Evans *via* a webcam.[5]

Cape Evans is located about 13 miles (21 km) north of Hut Point. The McMurdo Sound has open water during a fraction of the astral southern summer, January and February. For the remaining part of the year, the Sound is frozen, though the extent and thickness of the sea ice may vary from year to year.

Cape Evans, and thus the location of Captain Scott's hut for the *Terra Nova Expedition* "is a small triangular piece of land at the foot of the mountain. One side of the triangle is against the slopes of Erebus while the other two are washed by the waters of the Sound."[6] "The slopes of Erebus to the south of Cape Evans are quite impassable; hence when the sea is not frozen over Cape Evans is entirely cut off from the south. When the Sound is frozen over the sea ice forms a splendid surface over which the coast of Victoria Land can be reached or journeys made to the south."[7]

The *Terra Nova* arrived at Cape Evans on Jan. 4th, 1911, and after making a solid ice wharf at about 1½ miles from the shore the ice anchors were firmly placed. The Stevenson screen, a meteorological instrument shelter, was erected on Jan. 13th 1911, behind the hut on the top of a small 64-foot hill called Windvane Hill, which is located at the foot of the great slopes of Mount Erebus. The screen was about five feet above the ground, and thus 69 feet above sea-level. According to Dr Simpson, temperature measurements at Cape Evans were taken in free-air conditions.

The second occasionally operational land station during the *Terra Nova Expedition* was Captain Scott's old hut built by the *Discovery Expedition* at Hut Point. The Hut is located at the tip of Hut Point Peninsula (see Fig. 6.1.). Hut Point was a transition place for all parties venturing south. From this location, the Ross Ice Shelf (the Barrier) can be readily reached *via* the Gap, or rounding Cape Armitage about 3000 yards south-south-east of the Hut Point over the sea ice to the so-called Safety Camp located on the "solid" Barrier. In 1911, this point on the Barrier was only 12 feet above the sea ice. The meteorological readings were taken only occasionally by the parties which waited there until the Sound froze, or which waited there before continuing their journey.

The meteorological measurements at Cape Evans were performed by Dr Simpson, who was the Chief Meteorologist, and was supported by Canadian physicist Charles S. Wright as his assistant. On Mar. 4th, 1912, Dr Simpson returned to India under highly suspicious circumstances (see sections 10.1 and 10.3) and measurements were "continued" by Wright and Tryggve Gran. These measurements were continued until the end of August 1912[8] and not restarted until Jan. 22nd, 1913, when the *Terra Nova* left Cape Evans for good. While going through expedition accounts, I did not find an explanation as to why for about 5 months no one bothered to take meteorological measurements. This neglect of meteorological measurements is indeed perplexing, and contradicted the scientific merit concerns of the expedition.

6.1.2. Sledging Parties' Weather Records

During the *Terra Nova Expedition*, 8 sledging journeys, including the Main Polar Party sledging journey, were undertaken on the Ross Ice Shelf. These sledging journeys were accompanied by two motor parties and one dog sledging party. A relevant description of these journeys is collected in Table 6.1. All parties travelled more or less along the route of the Main Polar Party as depicted on Fig. 6.2. The starting points and returning points are given in Tab. 6.1. The meteorological measurements were taken each day at different geographical locations. The parties kept their meteorological journals, which were later edited and printed by Dr Simpson in his Volume III,

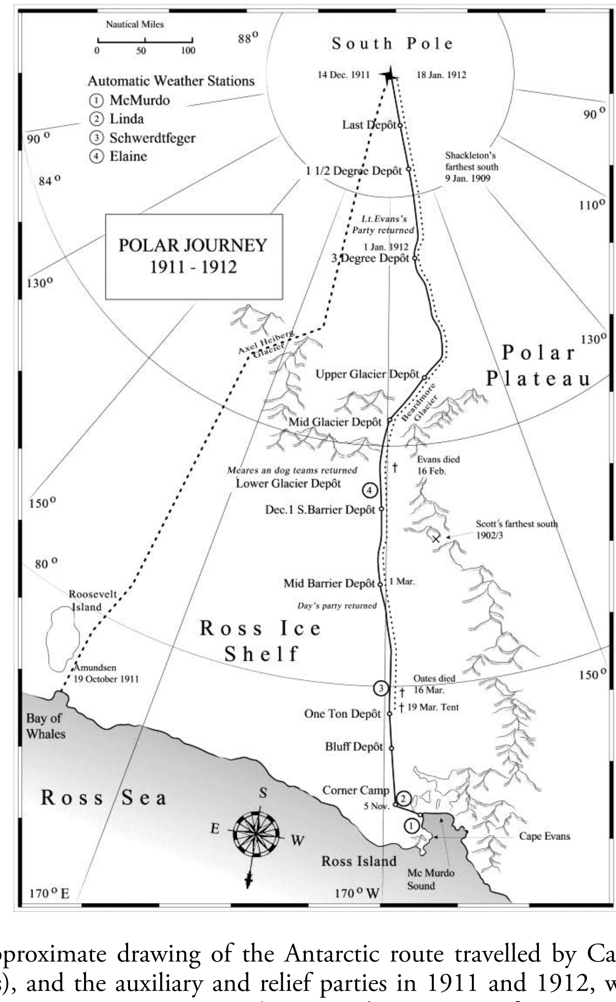


Figure 6.2. Approximate drawing of the Antarctic route travelled by Captain Scott (solid and dotted lines), and the auxiliary and relief parties in 1911 and 1912, which travelled essentially the same routes as Captain Scott's party. The positions of automatic weather stations are also shown: ① McMurdo Station {–77.85, 166.667} and Cape Evans {–77.63333, 166.4}, ② Linda AWS {–78.480, 168.375}, ③Schwerdtfeger AWS {–79.875, 170.105}, ④ Elaine AWS {–83.134, 174.169}. See figure legend for additional information.

Table 6.1. A summary of all sledging parties' dates of travelling and the journey routes over the Barrier and beyond.

Name of Party	Observer	Dates	Sledging Route
One Ton Depôt	Lt Bowers	Jan. 26th – Mar. 10th, 1911	Hut Point to One Ton Depôt and back
Corner Camp Party	Lt Evans	Sep.9th – Sep. 15th, 1911	Hut Point to Corner Camp and back
Motor Party Outward	Lt Evans	Oct. 27th – Nov. 21st, 1911	Hut Point to 80°32′S
Motor Party Inward	B. C. Day	Nov. 25th – Dec. 20th, 1911	81°10′S to Hut Point
Main Polar Party	Lt Bowers	Nov. 3rd – Mar. 12th, 1912	Hut Point to the South Pole and back
Dog Party	Meares	Nov. 5th – Jan. 4th, 1912	Hut Point to Mount Hope and back
1st Return Party	Wright	Dec. 22nd – Jan. 26th, 1912	Upper Glacier Depôt to Hut Point
2nd Return Party	Lt Evans	Jan. 4th – Feb. 22nd, 1912	87 °19′S to Hut Point
Depôt Party	B. C. Day	Dec. 26th – Jan. 21st, 1912	Hut Point to One Ton Depôt and back
1st Relief Party	Cherry-Garrard	Feb. 26th – Mar. 16^{th,} 1912	Hut Point to One Ton Depôt and back
2nd Relief Party	Dr Atkinson	Mar. 27th – Apr. 1st, 1912	Hut Point to Corner Camp and back

Section VIII: *Meteorological Registers Kept on Sledging Journeys from Cape Evans.*[9] The weather measurements included: temperature, pressure, wind strength/direction, and the state of the clouds.

6.1.3. The Ross Island Modern Weather Stations

Captain Scott's *Discovery* and *Terra Nova* expeditions, and Lt Shackleton's *Nimrod Expedition*, in addition to Captain Amundsen's *Framheim* base and Admiral Richard E. Byrd's *Little America* (1928–1930) expeditions, provided an answer to the question of the best site for further exploration of Antarctica. The Bay of Whales located at the Eastern edge of the Ross Ice Shelf was an unstable ice formation. Lt Shackleton selected Cape Royds, a rocky promontory 18 miles (29 km) north from Cape Evans, on Ross Island for his party. However, selection of both sites – Cape Royds and Cape Evans – was imposed by the ice conditions on arrival. Both locations, blocked by the mighty slopes of Mount Erebus, a 3,794 meters (12,448 ft) volcano, could also be cut off during the summer by frequent open water in the McMurdo Sound. Thus, the first site used by the *Discovery Expedition* at the southern tip of Hut Point Peninsula

provided the best location. At the edge of the Ross Ice Shelf, and easily accessible by sea, is where the aircraft ice landing strips are easily designed, built, and operated.

At present, two stations are present at the end of the Hut Point Peninsula. The biggest one, McMurdo Station, is the largest research station in Antarctica, and since December 1955 the logistics hub of the US Antarctic Program. At the height of the austral summer, the population of McMurdo Station is above one thousand and during the winter, when the station is entirely isolated, it is reduced to a quarter of this figure. The second and smaller station, Scott Base, is situated on Pram Point at the end of the Hut Point Peninsula in close proximity to McMurdo Station (see Fig. 6.1). Scott Base is run by the New Zealand Antarctic Institute, operating as Antarctica New Zealand. There were no routine meteorological observations conducted in Antarctica prior to 1957.

At both stations, continuous measurements of various meteorological variables are made, including near surface daily minimum temperature measurements. The results of these measurements are freely available to the public.

6.1.4. The Ross Ice Shelf Automated Weather Stations

An automated weather station is an automated version of the traditional weather station. An automated weather station may be used to save human manual labor. Just

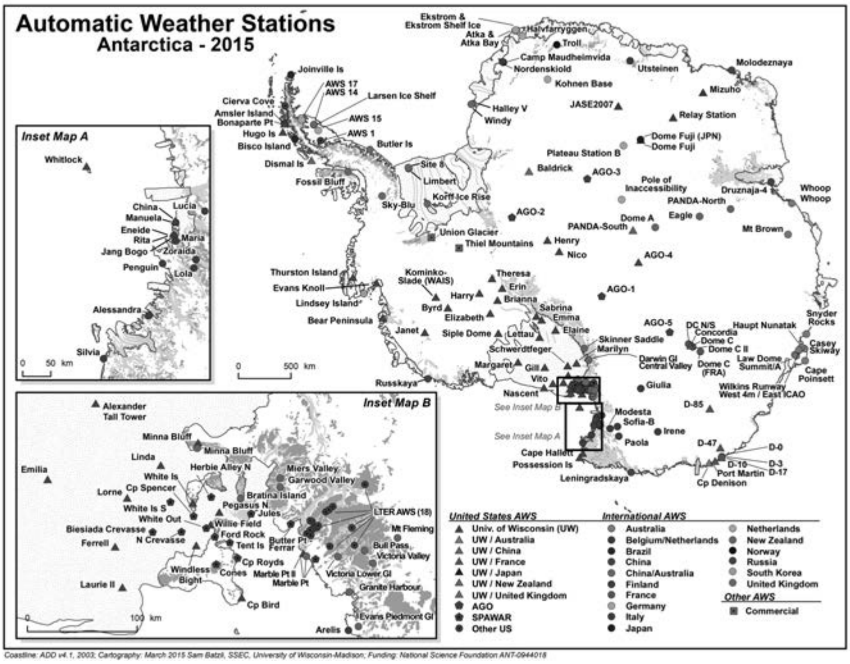


Figure 6.3. A map of known AWS shows the approximate distribution of AWS as of 2013. The University of Wisconsin's network includes all stations denoted with a triangle, regardless of color. © Antarctic Meteorological Research Center, Space Science and Engineering Center, University of Wisconsin-Madison, Madison, Wisconsin, USA.

imagine Dr Simpson or Wright walking up the Windvane Hill every hour of every day. But this was not the case, and Dr Simpson used a semi-automated commercial thermograph[10] which recorded temperature and time.

An automated weather station can also be used for wireless remote measuring of meteorological variables. However, two technical issues must be addressed. The first is power demand and the second is data storage. It was not until the nineteen seventies that low power consumption microprocessors were developed.

Today, the Antarctic continent is dotted with over one hundred and sixty automated weather stations, in addition to 47 manned Scientific Research Stations in the Antarctic Region, see Fig. 6.3. At present, about 70 automated weather stations are operated by the University of Wisconsin's Antarctica Automatic Weather Station program. Considering the size of Antarctica, it is not an impressive number compared with the number of weather stations in Europe or North America. Despite their limited numbers, these stations give a unique insight into real weather conditions, especially during the winter. On Fig. 6.2, I have depicted geographical positions of selected automated weather stations which are relevant to the analysis and discussion of the present topic.

6.2. Time

The question of time should be not overlooked. It is indeed an intricate question, both of philosophy and practicality. If one defines local time as the time at a particular place as measured from the sun's transit over the meridian at that place (defined as noon), then it is obvious that every place on Earth's surface has a different local time. Provided that all meridians meet exactly at both poles, one may rightly say that local time does not exist there or is constantly the same. But what time is it exactly at the South Pole? Well, if your wrist watch is set to show say McMurdo time, then even if after flying to the South Pole one places the watch at the South Pole, it will continue to show the actual time at McMurdo.

Dr Simpson summarized[11]

> Owing to the great convenience of using Greenwich time in the scientific work of the expedition, it was decided to keep our watches and clocks set to the time of the 180th meridian instead of to local time. In the following whenever times at Cape Evans or on journeys undertaken from Cape Evans are given without qualification they will be times according to this practice. Local time at Cape Evans is fifty-four minutes behind that of the 180th meridian, hence for most meteorological purposes, when local time is required, it is sufficient to deduct one hour from the times given.

Today, both the McMurdo Station and Scott Base are using New Zealand Standard Time (NZST), and all meteorological data from these stations are given in NZST.

In this book, I will be using temperature data from automated weather stations, most of which come from the stations named Schwerdtfeger {–79.875, 170.105} and Elaine {–83.094, 174.285}. These stations are roughly along the meridians of Scott Base {–77.85, 166.75} and McMurdo Station {–77.85, 166.6667}, and one could fairly

assume that the data from Schwerdtfeger and Elaine stations are given in NZST. However, this is not the case, and the respective data from these stations are given in NZST + 12h, which is Coordinated Universal Time (UTC).

In this book, I will be looking for relationships between near surface daily minimum temperatures at coastal and interior stations, and how the twelve hours difference plays an important role in providing accurate accounts.

6.3. Historical Meteorological Tools and Measurement Methods

6.3.1. Temperature

The weather station used by Dr Simpson and Wright was placed on Windvane Hill just behind the expedition hut at Cape Evans. The thermometers were about 5 feet above the volcanic tuff ground, which remained snow free during the year. "In the screen were (a) a mercury dry bulb thermometer, (b) a mercury maximum thermometer, (c) a spirit minimum thermometer; and (d) a bimetallic thermograph."[12]

The thermometer is an instrument for recording temperature, usually by means of the changes in the volume of mercury or spirit contained in a glass tube with a bulb at one end. The dry bulb thermometer was usually a mercury thermometer, which was protected from the rain water by the screen. It is possible that the dry bulb thermometer (as any other one) can get a film of water on it due to condensation, obstructing proper readings. However, as Dr Simpson ensured, the Stevenson screen was well ventilated and free-air readings were taken.

The two thermometers used by Dr Simpson differed in their physical properties of mercury and spirit. This difference is related to the freezing temperature (or as we should say in terms of modern terminology, melting temperature) of mercury, –37.9°F (–38.8°C), and ethanol, –174°F (–114.3°C). It was Gabriel D. Fahrenheit who used mercury instead of wine spirit for thermometers, and avoided negative temperatures by marking the freezing point of water at 32°F; the boiling point of water was subsequently marked 212°F. The use of the Fahrenheit scale in moderate climate countries is convenient due to the fact that temperatures below 0°F are of rare occurrence.[13] However, in the Polar Regions the variability of temperatures is greater. Temperatures below 0°F are frequent and temperatures below the melting point of mercury are regular, especially in Antarctica.

When the temperature of air rises, the mercury placed in the thermometer's bulb expands and forces its way into the glass tube. After reaching its maximum expansion, which indicates maximum temperature, the bulb cools. However, due to the strength of adhesion forces between the mercury and the glass tube, the length of the mercury thread in the thermometer remains unchanged. To restore operational function, one has to knock the mercury thread back into the bulb.

The minimum thermometer has a small metal index placed in an alcohol-filled bore and which ends with a bulb. The measurement is taken when the thermometer is placed horizontally. With dropping air temperature, the alcohol is naturally drawn toward the bulb. Due to the adhesion forces between the glass and alcohol and owing to the capillary action of the concave meniscus, the index is drawn toward the bulb. When the air temperature stops decreasing, the alcohol and the index stop moving

down the bore. When it rises again, the index is left stationary in the tube, and its upper end indicates the lowest, or minimum, temperature. To reset it, it is necessary to invert the thermometer, and the index will flow again to the end of the alcohol column.

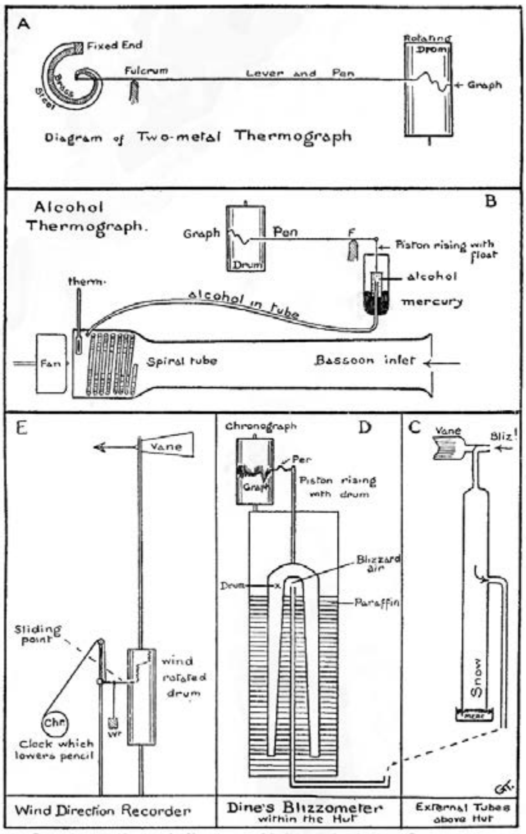
The thermograph is a self-recording thermometer consisting of a bimetallic spiral with a suitable index. See the self-explanatory Fig. 6.4. Dr Simpson used two semi-automated thermographs. One, called the Screen Thermograph, was placed together with other thermometers on Windvane Hill in the Stevenson screen. "It was realised back in England that one could have difficulty with the thermograph in the screen."[14] And the second, called the Hut Thermograph, was placed in the Cape Evans hut at "Simpson's corner".[15] Since the *Discovery Expedition*, the difficulties with instruments exposed to Antarctica's weather are well known. "These instruments [mercurial thermometers] gave considerable trouble on account of the column breaking, and a large number of them were broken in the vain attempts to restore them to working order."[16]

Dr Simpson, along with Wright, noticed that "When the temperature fell below about –30°F the clock stopped in spite of all the oil having been cleaned out of the bearings; also the whole instrument became choked up with driven snow during blizzards." Therefore, the Screen Thermograph needed constant attention. However, the recording troubles at low temperatures were anticipated back in England before the expedition, and a special indoor thermograph to record outside temperatures was built.

The construction of the Hut Thermograph is shown on Fig. 6.4. T. Griffith Taylor, in his splendid book loaded with technical details, described the essential elements of the thermograph. "The large brass bassoon and copper coil were outside the hut in the "weather cupboard", while the small float and drum were inside the hut. The air drawn into the bassoon by the fan affected the volume of the alcohol in the copper tube, and so raised or lowered the little float, and so actuated the pen."[17]

The temperature recording instruments, described above, were used at the Cape Evans hut. Equally important, however, were the meteorological observations during the sledging journeys. The important question was how to ensure air-free temperature measurements. At home base, the screen and its placement ensured air-free measurements of minimum, actual and maximum temperatures. "Some form of the sling thermometer was the only alternative. The simple method of swinging a thermometer on the end of a string becomes practically impossible when one has to work in thick mitts, and in bulky clothes nearly as stiff as sheet metal owing to the frost. After considerable thought and experiment, a form of sling thermometer based on a very old principle was designed, which proved to be admirable in every way when put to the service test of continued use on sledging journeys"[18] Fig. 6.5 illustrates the constructed device to perform dry bulb measurements on sledging journeys. The device was a sling thermometer, in which a spirit thermometer was mounted was made of aluminum. However, the sling thermometer used by Lt Bowers throughout the S*outh Pole Journey* had a wooden handle.

The same South Pole party was also using a minimum temperature thermometer. Dr Simpson described the procedure of taking a measurement: "Nearly all the sledging thermometers (spirit) were provided with minimum indices, and after the sledge had been straightened for the night the open thermometer was carefully placed under



Copied from Simpson's diagrams at his lecture in the hut, June 3, 1911.

Figure 6.4. The construction of the Hut Thermograph.[1] A – Diagram of Two-metal Thermograph, B – Alcohol Thermograph, C – External tubes above Hut at Cape Evans, D – Dine's Blizzometer with the Hut and E – Wind Direction Recorder.

[1] T. Griffith Taylor, *With Scott: The Silver Lining*, Smith, Elder & Co., London, 1916, *cf.* p. 221.

the sledge in such a position that it was shielded from radiation."[19] The thus measured minimum temperatures were collected in tables by Dr Simpson, who further observed that "There is little doubt that a thermometer so placed gave minimum temperatures too low by a degree or two …"[20] Dr Simpson did not give a hint as to why he was thinking that the sledge measurement of minimum temperature should be too low by a degree or two. I can only guess that Dr Simpson's argument resulted from analysis of possible air temperature differences between simultaneous wet and dry thermometer measurements. The actual difference between dry and wet thermometer readings is used by researchers to measure air humidity by the instrument called a hygrometer. In *An Elementary Treatise on Heat*, published in London in 1889, its author Henry G. Madan, a fellow of Queen's College at Oxford, explains: "Thus a mere comparison of the readings of the two thermometers will show whether the air is moist or dry; if the former, the readings of the 'wet-bulb' will be lower by 2°, or more, than that of the 'dry-bulb'."[21] The dry-bulb measurement of the temperature of the air will be

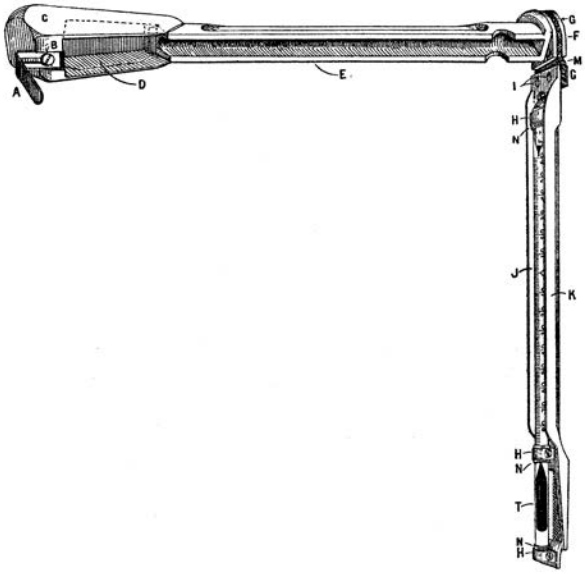


Figure 6.5. The sling thermometer used by Lt Bowers during the *South Pole Journey*. See the text for a description of the different parts of the thermometer.

the same as measured by an air-free thermometer shielded from solar radiation and moisture. The wet-bulb temperature is the air temperature of systems in which latent heat is a major heat-balance component.[22] For a given air condition at a known pressure, for dry and wet bulb temperatures, there will be a unique relative humidity and dew point. By entering these variables into equations, both of the values of relative humidity and dew point can be readily calculated. In the past, at the time of the *Terra Nova Expedition*, by finding the dry and wet bulb temperatures in special tables, the humidity of the air could be obtained. But what is the value of the relative humidity in Antarctica? Antarctica is a Polar desert! Since the *Discovery Expedition*, it has been well known that the humidity of Antarctica is extremely low. W. H. Dines in his analysis of the readings of dry and wet thermometers collected during the expedition observed "The general opinion of meteorologists seems to be that the tables by which the relative humidity is obtained from the wet and dry bulb readings are open to doubt at very low temperatures and very low values of the humidity, and hence it hardly seems worthwhile calculating the values of the humidity from these readings."[23] "The most obvious omission in the meteorological record" – commented Simpson on the records of *Terra Nova Expedition* – "is that of atmospheric humidity."[24] Dr Simpson decided not to take wet bulb thermometer readings, and added "With the whole of the wet bulb readings taken on the *Discovery Expedition* unused I did not feel inclined to add to the accumulation."[25]

Provided that on every night the minimum temperature thermometer was placed under the sledge and was ventilated by freely moving air, there is no argument that its reading could or should be lower (about 2 degrees) than the actual minimum temperature. Because of the very low humidity in Antarctica, and because we are especially interested in minimum temperatures during the final stages of Captain Scott's march,

from Feb. 27th through to Mar. 19th 1912, I argue that the readings of the minimum temperature thermometer *should not be* corrected as was suggested by Dr Simpson.

In 1999, the American scientists Dr Susan Solomon and Dr Charles R. Stearns should have angered the polar community and polar enthusiasts alike with their idiosyncratic and biased revelations. I have referenced their work published in the distinguished Proceedings of the National Academy of Science (PNAS) several times throughout this book (see Chapter 4). Now, in relation to Dr Simpson's incorrect comment about possible differences between real and measured under the sledge minimum temperatures, I present one of the many incorrect statements from Drs Solomon and Stearns. They incorrectly observed

> At night, the sling thermometer was sometimes placed under one of the wooden sledges (a type of sled that carried supplies) to shield it from the sun and to estimate the nightly minimum temperature. Although such observations may be biased low by up to 2° because of the pooling of cold air (ref. 4, p. 19), the ventilated data taken while swinging the thermometer only a few times per day are likely to be warmer than the actual daily minimum. It is therefore probable that the true 1912 minima lie between the ventilated and under-sledge data; both will be shown here where available.

Dr Simpson casually and incorrectly suggested that the minimum temperature was "low by a degree or two". Drs Solomon and Stearns, without sensible reflection on the issue, accepted this and also added a new phenomenon "of the pooling of cold air". To prove "the pooling" effect, Drs Solomon and Stearns incorrectly attributed it to Dr Simpson's work "(ref. 4. p. 19)". Dr Simpson did not mention "the pooling of cold" air but, as I have shown above, he confused the issue of humidity or rather its non-presence in Antarctica's cold air.

I will return later to Dr Solomon's false account cited above. First, I will pose a question. What was the point of using a sling thermometer during the sledging journeys of the *Discovery* and *Terra Nova Expeditions*? Dr Simpson informs us that[26]

> It was usual during sledging to take meteorological observations each time camp was made and broken. Thus normally observations were taken three times a day:
>
> - In the morning just before the march for the day commenced,
> - Near midday, during the lunch halt,
> - In the evening after the tent had been erected and while the evening meal was being prepared.

The sling thermometer used by Lt Bowers as depicted on Fig. 6.5 was of a special construction. "The back K is hinged by means of a piece of raw hide at M so that after use the back folds over the handle, in which a groove E, D has been cut to take the thermometer. When closed and the back secured by the sliding catch A (made very large so that it can be opened and closed with the hand in mitts), the thermometer is enclosed in a strong metal box and it is practically impossible to break no matter how roughly the instrument is handled."[27]

Therefore, the sling thermometer, protected by its construction, was stored somewhere during the sledging. I did not find any description or reference on how and

where this important instrument was stored. However, it would be a fair to assume that it was safely kept somewhere on the sledge which was exposed to all "hazards" including solar radiation. Therefore, before taking a measurement it was vital to sling the thermometer to restore its state of in open air measurement. It is obvious, contrary to Dr Solomon's remark, that if at a given time a minimum temperature thermometer was reset, its measured temperature must be identical with the sling thermometer.

6.3.2. Wind Velocity and Direction

Wind is a complex phenomenon. In section 1.4, I showed that the wind near surface velocity in Antarctica is a self-organized criticality phenomenon. The main feature (but not the only feature) of the winds in Antarctica is their gustiness. Velocity is a physical variable vector, whose definition requires knowledge of its magnitude and direction. To calculate the magnitude of velocity, one has to speak about average velocity $\upsilon_{ave} = \Delta x/\Delta t$, where Δx is the distance the object travelled within Δt period of time. This velocity formula is useful if the distance change is relatively smooth; say the wind is not gusty. In such a case, the "resolution" of the wind velocity measuring device is not important, and the Robinson anemometer used at Cape Evans would give a fairly precise wind velocity. However, if the gustiness (see section 1.4) increases and the relationship between the inertia of the anemometer and the gustiness of the wind becomes more and more important, one has to think about the instantaneous velocity ($\Delta t \rightarrow 0$) of the wind. Interesting research was recently reported on this issue by using artificial neural networks.[28]

Dr Simpson, in his account of wind velocity and wind direction measurements, did not comment on these specific issues. He also did not estimate the accuracy of these measurements in Antarctica. He only informed that "a [A] small Robinson anemometer having 3-inch cups on $7^3/_8$-inch arms and calibrated to the factor 2.73" was "considered to be the standard instrument".[29] Of course, who determined what standard should be used in Antarctica? From this account, it appears that Dr Simpson trusted the measured wind velocity and wind directions at Cape Evans.

It also appears that during the sledging journeys, and especially during Captain Scott's journey to the South Pole and back, the wind velocity was observed and reported in the Beaufort scale.

6.4. Modern Meteorological Tools and Measurement Methods

I have already mentioned in subsections 6.1.2 and 6.2.2 that modern meteorological data is recorded at McMurdo Station, Scott Base, and at various locations across the Ross Ice Shelf. I have to admit that I was not able to establish much information about the tools and methods of taking measurements at the McMurdo and Scott Base stations. Therefore, I have to take for granted that these measurements of near surface minimum daily temperature, pressure and wind speed and its direction are taken by state of the art instruments.

The main components of automated weather stations operated by the University of Wisconsin's Antarctic Automatic Weather Station program are fairly well described.[30]

Fig. 6.6 depicts the layout of the automated weather station unit used in remote measurements of basic meteorological parameters. The installed station unit has a tower of about 3-metres height, with a horizontal boom supporting the antenna, an aerovane for measuring wind speed and direction, an air temperature resistance thermometer, an upper thermopile for measuring vertical air temperature difference, and a relative humidity sensor. The electronics enclosure is mounted at the midpoint of the tower. The gel cell batteries are placed at the tower base. The 10-Watt solar panel, located near the tower's top, faces north.

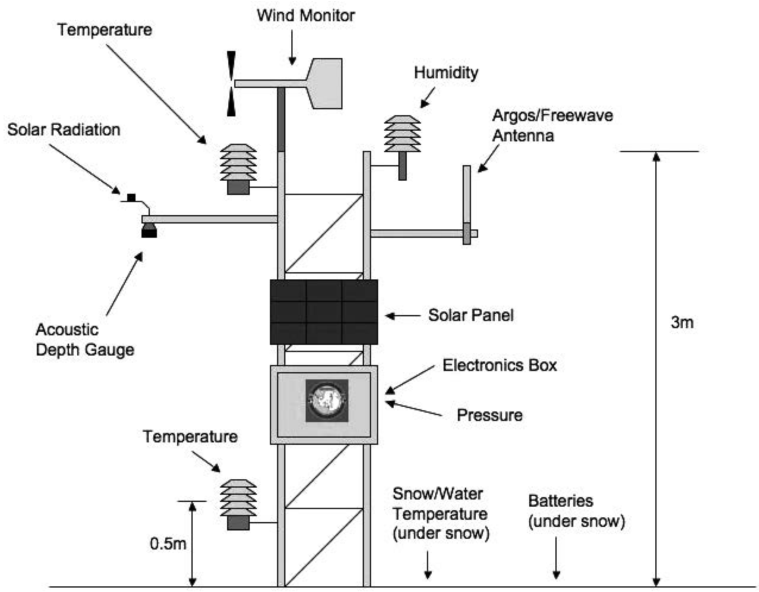


Figure 6.6. Scheme of an AWS unit used in Antarctica. © Antarctic Meteorological Research Center, Space Science and Engineering Center, University of Wisconsin – Madison, Madison, Wisconsin, USA.

6.5. Historical and Modern Data Acquisition

All meteorological data recorded during the *Terra Nova Expedition* is discussed and collected in Dr George Simpson's three-volume treatise. "Many meteorologists will look in vain in this book for statistical results with which they have become familiar in similar works. I am no statistician and statistical meteorology has no attraction for me, therefore I have not loaded my discussion with statistical tables. These have all been banished to Volume III which will consist of tables only will, I hope, prove a happy hunting ground for the statistical meteorologist. On the other hand, no statistical investigation has been too laborious when it has been undertaken to unravel some physical problem."[31] I am not a "statistical meteorologist" but rather a theoretical physicist. However, not only Vol. III, but also Vol. I was "a happy hunting ground" for me.

The sledging parties did not take hourly measurements for obvious reasons. Usually, three measurements were taken: in the morning, at lunchtime, and in the evening. Some sledging parties, for example, the Main Polar Party, were carrying so-called minimum temperature thermometers, in addition to regular spirit thermometers. Captain Scott's party used high-quality thermometers, calibrated at Kew Observatory, London. Sling and dry-bulb thermometers were used with precision, and measured to about a ± 0.5°F uncertainty. A specially constructed sling thermometer with a wooden handle was broken by Lt Bowers on Mar. 10th, 1912. From that day on, only Captain Scott's personal spirit thermometer data was available. The only thermometer left after Mar. 10th, 1912 was Captain Scott's personal spirit thermometer, which was found by the search party in 1912. Charles Wright tested its calibration back in London. Test results proved this thermometer's accuracy within a tenth of a degree.[32]

Since the minimum temperature thermometer was broken by Lt Bowers on Mar. 10th, 1912 and likely thrown away, no one could re-test its accuracy after Captain Scott's journey to the South Pole. However, for the following reasons it is fair to assume that the thermometer used to measure daily minimum temperature – let us call it *Lt Bowers's minimum thermometer* – was working according to its original ±0.5°F uncertainty:

1. Lt Bowers' minimum thermometer passed quality tests and was calibrated at Kew Observatory, London,
2. Dr Simpson in Antarctica performed several tests of thermometers (not taken by Captain Scott's party), and concluded that "… I believe, with a fair degree of certainty, but as some doubt still remains the maximum and minimum temperatures during the second year may be in error by ±0.5[°F]"[33]
3. At no instance were the thermometers taken by Captain Scott's party reported as malfunctioning,
4. At no instance did Lt Bowers and/or Captain Scott during the South-Pole journey report the malfunction of Lt Bowers' minimum thermometer and/or Captain Scott's personal thermometer,
5. If Lt Bowers' minimum thermometer was malfunctioning, we require an explanation as to why:
    5.1. It was showing lower than actual temperatures, or
    5.2. It was showing higher than actual temperatures, or
    5.3. It was showing random temperatures.
6. If Lt Bowers' minimum temperature thermometer was malfunctioning, we require an explanation as to why during the *Extreme Cold Snap* from February 27th through to March 27th, 1912 Lt Bowers' record coincides with Captain Scott's record,
7. In relation to the above point, we require an explanation as to why after March 10th, Captain Scott's personal thermometer continued to record temperatures in the previous range,
8. We also require an explanation as to why on Mar. 4th, 1912, both Lt Bowers' minimum thermometer and Captain Scott's thermometer miraculously self-corrected their previous malfunctioning and resumed malfunctioning after that date,

9. We require an explanation as to why Captain Scott constantly complained in his journal, his *Message to the Public*, and farewell letters about the continuous very cold temperatures.

Therefore, no one needs to know whether Lt Bowers' and/or Captain Scott's thermometer was tested after the expedition to see that the superficial "malfunctioning of the thermometers" explanation does not hold water.

Modern readings of meteorological instruments at the McMurdo and Scott Base stations are continuously collected in real time, and the collected data is electronically stored. From this data, the daily near surface air minimum temperature is found and stored in various formats, including MS Excel spreadsheets, which I have used in my work.

Each automated weather station measures wind speed, wind direction, temperature, and atmospheric pressure. The wind speed, wind direction, and temperature gauges (sensors) are mounted at the top of the tower, at a nominal height of 3m. Station atmospheric pressure is measured at a nominal height of 1.5 m. The heights of the gauges (sensors) may change due to snow accumulation at the site. Measurements from the sensors are made every 10 minutes and are transmitted *via* the ARGOS data collection system to be processed at the University of Wisconsin. A semi-automated quality control process is applied to 10-minute data. The untreated data is also available. Hourly observations are created using the closest valid observations within 10 minutes of the hour from quality control processing. The accuracy of temperature measurements at AWS is between ±0.5 to ±0.125°C, wind velocity ±1%, and wind direction ±3°.[34]

As in the case of the McMurdo and Scott Base Stations, the daily near surface temperature at each automated weather station was found by searching the 10-minute data. Temperature accuracy is 0.25°C – 0.58°C, with the lowest accuracy occurring at temperatures of –70°C: that is, accuracy decreases with decreasing temperature.[35]

6.6. Weather Forecasting

To you a robot is a robot … But
you haven't worked with them …
They're a clever,
better breed than we are.
Isaac Asimov[36]

In the preceding chapters, I was concerned with a critical review of the weather record during Captain Scott's South Pole journey. All previous "in-depth investigations" of Captain Scott's meteorological records starting with Dr Simpson (see Chapter 3), and ending with Dr Solomon (see Chapter 4), have had grave drawbacks, with the confusion of weather and climate, data fabrication and falsification, supported by fallacious analysis.

A natural question arises: what is the reason for studying the meteorological records of Captain Scott's party? Dr Simpson explained[37]

> Whatever other causes there may have been, there can be no doubt that the weather played a predominating part in the disaster and, as we have just seen,

> was the immediate cause of the final catastrophe. We will therefore consider the weather conditions encountered and see what lessons can be learnt from them, and, above all, try to determine whether they were the normal condition or whether they were abnormal in their severity.

However, Dr Simpson's analysis falls short on many grounds, as I explained in Chapter 3. Most importantly, Dr Simpson confused weather and climate, and arrived at the conclusion that the Captain Scott party was struck by abnormal weather, meaning abnormally low temperatures. Whatever arguments Dr Simpson presented, he was short of temperature data on the Barrier as well as at Cape Evans. Although I have said that he was short of data, it must be said that no one before or long after Captain Scott's journey was on the Barrier from Feb. 27th through Mar. 27th, 1912. It is right to say that Dr Simpson had only one set of temperature data – Captain Scott's data – and he could say nothing about the rarity of this record. The concept and the difference of climate and weather at the time of Dr Simpson's work was well known[38]

> *Climate*. A general summary of the weather for any particular locality. When the weather has been observed for a sufficiently long time in any locality we are able to make a useful statement as to the weather which may be experienced at any particular time of the year in that locality. Technically, the climate of a place is represented by the average values of the different meteorological elements.

However, this fundamental meteorological concept, supported by common sayings and knowledge, was not known to Dr Simpson, and three years after he was appointed Director of the Meteorological Office in 1920, he delivered his fallacious account. Did any brave individual during Dr Simpson's Halley Lecture ask the question about his confusion of weather and climate? Why did Dr Simpson not say that due to lack of a sufficient amount of daily minimum temperature data, one *cannot* present educated guesses?

I think that in presenting his fallacious analysis, Dr Simpson whitewashed his *apparent* role and responsibility in planning Captain Scott's journey to the South Pole. After all, in the eyes of others it was his responsibility to advise Captain Scott on the meaning of weather patterns he noticed. Therefore, Dr Simpson could wrongly be accused of not figuring in weather on the Barrier for the period of Feb. 27th through to Mar. 27th, and therefore the Captain Scott party perished on his watch. In other words, in the eyes of others, the temperatures on the Barrier at any given time of year regularly hover around –40°F, and Dr Simpson should have been aware of that and warned Captain Scott. However, if Dr Simpson *ex nihilo* proclaimed that the weather was entirely "abnormal," his responsibility (though false) as the Chief Meteorologist of the *Terra Nova Expedition* was taken away, as no one was able to predict *abnormal* weather behavior.

It may seem audacious to ask again the old question of whether the Feb. 27th through Mar. 27th, 1912 *Extreme Cold Snap* really happen? Did the Mar. 21st through Mar. 29th, 1912 *Never Ending Gale* happen?

My critical examination of weather concerns related to Captain Scott's *Terra Nova Expedition* presented by previous authors would be only partly useful if I could not present new material. Indeed, it is uncustomary to be solely dangerously critical about the work of predecessors. But Dr Solomon's *The Coldest March* could hardly

be called an important scientific work/analysis, as it was not even wrong. It has sown lies supported by fabricated and falsified meteorological data. As such, it should be called pseudoscience.

In Chapter 1, I briefly mentioned early twentieth century attempts of *numerical* weather forecasting by Wilhelm Bjerknes and Lewis Fry Richardson. Since that time, a great deal of progress has been observed and supported by powerful computing machines, algorithms, and many meteorological data, year after year improving the skill of short and long term forecasts.

Since these numerical forecast methods require large sets of spatiotemporal meteorological data, their applicability to investigate the weather conditions during Captain Scott's expeditions is essentially useless. However, research experience tells us that there are always solutions even to the most difficult questions. And that these solutions sometimes come from unexpected quarters.

6.6.1. God and Arrogant Humans

The human desire to predict the weather was developed in earnest at the "out of Africa" stage, when general curiosity about nature became evident. The need to understand humanity's desire to control not only nature, but predominantly to control fellow humans is as old as humanity itself. The process of human evolution from qualities to quantities and to theories began in the past, and will last for millennia.

The catalogue of changes observed in nature may be divided into artificial categories of fairly regular phenomena (time of the year, time of the day, *etc*.), and fairly irregular phenomena like say the weather, and its related phenomenon climate.

In Chapter 1, I briefly sketched the struggle to understand and predict the weather by means of formulating mathematical and later computational tools. The early ideas of Lewis Fry Richardson described in his visionary book entitled *Weather Prediction by Numerical Process* and published in 1922 contained, however, a fallacy which has effectively percolated itself into modern thinking. The fallacy is that the weather and/or climate can be, at least in principle, described in deterministic terms. It assumes that if the agent (us) can get more and more granularity in the collection of current meteorological data and computing power, then the precision of weather prediction will freely increase.

Just to illustrate this modern Nostradamus-like fallacious thinking one more time, not for the last time we encounter Dr Susan Solomon, who once again produced a pitiful "scientific result". Fig. 6.7 depicts the respective figure taken directly from the article *Persistence of Climate Changes due to a Range of Greenhouse Gases* by Susan Solomon *et. al* and published in Proceedings National Academy of Sciences (USA) **107**(2010)18354–18359.[39] The authors argue that global warming due to non-CO_2 (carbon dioxide) greenhouse gases will persist notably longer than the anthropogenic changes resulting from the greenhouse gas concentrations.[40] These authors concluded that one should not expect the "*decrease[ing] climate change impacts as rapidly as the gas or aerosol lifetime*".

Using a certain computational model enigmatically called the Bern 2.5CC model, Dr Solomon *et al*. make an inference about the land and ocean temperature in about 1000 years, [*sic*] starting from the time frame of now (see Fig. 6.7). According to their

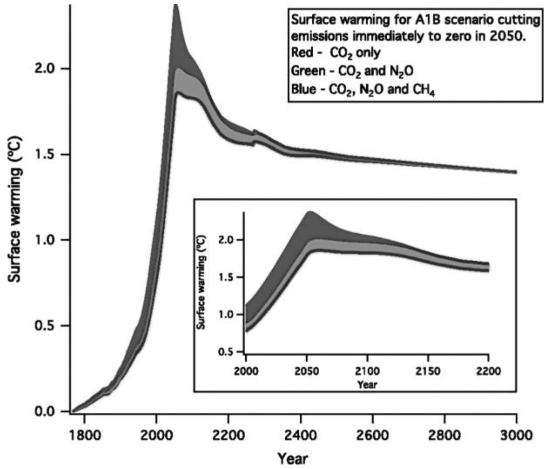


Figure 6.7. Reproduction of the original figure taken from the paper by Susan Solomon, John S. Daniel, Todd J. Sanford, Daniel M. Murphy, Gian-Kasper Plattner, Reto Knutti and Pierre Friedlingsteine, *Persistence of Climate Changes due to a Range of Greenhouse Gases*, published in Proceedings of the National Academy of Sciences (USA) **107**(2010)18354–18359. The figure indicates calculated surface warming from now until the year 3000 [*sic*]. [Original Caption: Computed surface warming obtained in the Bern 2.5CC model due to CO_2, CH_4, and N_2O emission increases to 2050 following a "midrange" scenario (called A1B; see ref. 23) followed by zero anthropogenic emissions thereafter. The gases are changed sequentially in this calculation in order to explicitly separate the contributions of each. The bumps shown in the calculated warming are due to changes in ocean circulation, as in previous studies (5, 26, 39). The main panel shows the contributions to warming due to CO_2, N_2O, and CH_4. The inset shows an expanded view of the warming from year 2000 to 2200.] © 2010 by National Academy of Sciences.

main result, the temperature surface warming will be about 1.4°C in the year 3000 [*sic*]. No statistical analysis or initial data assessment is presented to support these computer generated figures and conclusions. This analysis leaves the public *suspended in uncertainty* for nearly the next 1000 years. Does anyone, including the Proceedings National Academy of Sciences editors and National Academy of Sciences members, believe in Dr Solomon *et al.*'s ability of scientifically (or otherwise) predicting surface warming 1000 years [*sic*] from now? If indeed Dr Solomon *et al.* were able to make such a scientific prediction, what are the error bars of the predicted warming? Of course, Dr Solomon *et al.* presented computer-generated nonsense, and only doubled Nostradamus' original prophecy range. The Nostradamus-like race to get "more insight" in the subject described above continues, with a recent record detailing a 10000 (10k) years [*sic*] prediction.[41]

I quoted the dubious studies above as a caution to the investigative reader, who should not be fooled by self-proclaimed demons and impostors. The understanding of determinism was exemplified by

> Nothing occurs at random, but everything for a reason and by necessity. [Leucippus, 440 BCE]

> In nature there is nothing contingent, but all things have been determined from the necessity of the divine nature to exist and produce an effect in a certain way. [Spinoza, 1677]

> There are no accidents in my philosophy. Every effect must have its cause. The past is the cause of the present, and the present will be the cause of the future. All these are links in the endless chain stretching from the finite to the infinite. [Abraham Lincoln][42]

through the Laplace demon, as quoted in Chapter 1, to the doubtful realization that

> The law of causation, according to which later events can theoretically be predicted by means of earlier events, has often been held to be *a priori*, a necessity of thought, a category without which science would not be possible. These claims seem to me excessive. In certain directions the law has been verified empirically, and in other directions there is no positive evidence against it. But science can use it where it has been found to be true, without being forced into any assumption as to its truth in other fields. We cannot, therefore, feel any *a priori* certainty that causation must apply to human volitions. [Russell, 1914][43]

to "Hurst-Kolmogorov behavior" of natural phenomena which exhibit an *intrinsic* uncertainty. This intrinsic uncertainty is embedded in classical Newtonian mechanics, due to the apparently non-linear behavior of even the most simple equations. I discussed the matter in Chapter 1, and the investigative reader may consult it to recall the general properties of chaotic systems. Here, just let me mention the three-body (or n-body)[44] problem of classical mechanics. Isaac Newton, in his *Principia* in 1687, provided an analytical solution of two-body motion under their mutual gravitational interaction. However, he also considered three-body motion celestial bodies, which required a much more difficult if not impossible solution, as was discovered during the next three hundred years of fruitless research of analytical (deterministic) solutions. It means that in the case of three celestial bodies: say the Earth, Sun, and Moon, if one tries to predict (calculate) a location (position) in 3D space for a given moment of time, this relative position is inconclusive and chaotic. Since the solution of equations of motion requires specification of initial conditions, at time $t = 0$ (which is an arbitrary moment of time assumed to be zero at the moment of specifying the initial conditions) one will get an infinite number of approximated solutions which may differ by an arbitrarily large number. It means that an arbitrarily small change in initial conditions will lead to entirely different behavior to the system in later moments of time.

The term "butterfly effect" was coined to underline that if today a butterfly flaps its wings, this will cause a hurricane in three weeks time over the central Atlantic. Of course, the butterfly alone can't cause a hurricane. It is equally obvious that the very physical presence of Captain Scott's party on the Barrier during their return from the Pole did not change (influence, perturb) the initial conditions, and the weather during that time was not behaving out of the ordinary.

The investigative reader may observe that the above explanation is in apparent contradiction with the infinite sensitivity of equations of motion on the initial conditions mentioned previously. However, this is not the case, since the initial conditions specify all conditions at the given localization and time. Thus, weather which is sensitive to *all*

causes and causation virtually disappears, and the weather appears to be a "random" like phenomenon.[45] Indeed, an intriguing question arises: does every event have a cause?

In a similar fashion, the reader may wonder about the chaotic character of three-body motion equations illustrated by the Earth, Sun, and Moon and its solution as mentioned above. With computers now we can calculate, with even greater precision the mutual locations relative to each other of the Earth, Sun and Moon. However, the time window at which we can run these calculations is limited, and after say 100 million years, the behavior of motion of these celestial bodies *is* uncertain.

The word *probability* is frequently used in everyday communication, and it appears that everyone has a good understanding of its meaning. However, even in this book and particularly in Chapter 4 while analyzing Dr Solomon's "results," it became evident that fallacious probabilistic reasoning was presented. The fundamental question arises: is the notion of probability an *epistemic notion* related to quantities? Most scientists tend to think that the notion of probability is *epistemic* and not an *ontic* notion. Some, like Bruno de Finetti, are even saying that in the case of an *ignorant* agent[46]

> My thesis, paradoxically, and a little provocatively, but nonetheless genuinely, is simply this: *Probability Does Not Exist*. The abandonment of superstitious beliefs about the existence of the Phlogiston, the Cosmic Ether, Absolute Space and Time, … or Fairies and Witches was an essential step along the road to scientific thinking. Probability, too, if regarded as something endowed with some kind of objective existence, is no less a misleading misconception, an illusory attempt to exteriorize or materialize our true probabilistic beliefs.

In the following subsection, I will add some more comments related to the issues mentioned above which I briefly discussed to point out the sensitivity of the matter.[47] In no way, however, did I want to say that by using certain methods, equations, and computing power of computers, one cannot predict with reasonable accuracy the weather at a given location. We all know that these predictions sometimes fail miserably, but we also know that in many situations the meteorologists are capable of figuring out the weather. We also know that the crucial role that the quality (accuracy) of weather prediction (forecasting) plays for the *time window* which one wants to forecast[48]

> Typically 10^{10}–10^{11} equations have to be calculated in the operations of national and international meteorological organisations when they produce their regular forecasts for the global weather. They utilize both the largest computers in the world and 100 million observations per day which, according to the World Meteorological Organisation, now cost more than $1 billion [$10^{12}$] per year. The question of how to optimally incorporate satellite observations of particular atmospheric features, together with the more traditional ground and ship based observations is one of growing importance both scientifically and economically. One could say that this effort has 'paid-off' because the errors, which increase with the number of days ahead for the forecasts, have been steadily decreasing, so that a 3–day forecast today is by many measures as accurate as a 1–day forecast 20 years ago. Forecasts for up to 7 days are now regularly issued and found to have useful accuracy on continental scales. However, to maintain this downward trend in errors, continuing research is essential.

6.6.2. Nansen's Connection

At the beginning of this book, I mentioned the Laplace demon and the economic agent *homo œconomicus* who played cosmic and market games, respectively. One can ask: according to what rules was each game played? Apparently, the Laplace demon was capable of calculating each particle's trajectory and thus predict the future. Thus, this unspecified intellect is capable of observing the current state of the universe and forecasting its evolution. John S. Mill's rational *homo œconomicus* agent's actions were regular and predictable like elements of a mechanical system, and thus predictive if and only if the initial conditions were known and precisely measurable. In Laplace's own description[49]

> We ought to regard the present state of the universe as the effect of its antecedent state and as the cause of the state that is to follow. An intelligence knowing all the forces acting in nature at a given instant, as well as the momentary positions of all things in the universe, would be able to comprehend in one single formula the motions of the largest bodies as well as the lightest atoms in the world, provided that its intellect were sufficiently powerful to subject all data to analysis; to it nothing would be uncertain, the future as well as the past would be present to its eyes. The perfection that the human mind has been able to give to astronomy affords but a feeble outline of such an intelligence. Discoveries in mechanics and geometry, coupled with those in universal gravitation, have brought the mind within reach of comprehending in the same analytical formula the past and the future state of the world. All of the mind's efforts in the search for truth tend to approximate the intelligence we have just imagined, although it will forever remain infinitely remote from such an intelligence.

The above-posted question about the rules played by the Laplace demon and economic agent has an answer: the rules of the game are deterministic, *i.e.* "all events, including human choices and decisions, have sufficient causes and exemplify natural laws." The causes may be different. For Adam Smith, the self-interest of man tends to maximize the welfare function. "It is not from the benevolence of the butcher, the brewer, or the baker, that we expect our dinner, but from their regards to their own interest."[50] For John S. Mill, who paved the road to Anglo-American utilitarianism (see Chapter 12 for its connection to the Captain Scott story), the happiness of the majority of people was affirmed to be the greatest good of ethics. For Newton, who formulated the foundation of classical physics, his (or any supernatural entity's[51]) laws of mechanics are causes which drive celestial and Earthly bodies. Therefore, the Laplace demon must use Newtonian mechanics in its calculations.

The discussion about the relationship of determinism and predictability has a long history. For some, "Theoretical determinism, as it is usually ascribed to Laplace, is neither verifiable not falsifiable and has therefore no real content. It is not the same as predictability of actually observed phenomena."[52] For others like Boltzmann, Darwin and Prigogine,[53] who in studying populations showed that small random fluctuations of "individuals" (agents) can lead to evolution at the collective level. But even at the most elementary level of Newtonian dynamics, one could observe that the evolution of a system sensitively depends upon the initial conditions of the system. Thus, the eccen-

tric name *chaos theory* was coined for a mathematical apparatus describing the evolution of the trajectories of such a system. Although the evolution of the system is dependent upon initial conditions (or their change), its evolution was purely deterministic. Even an infinitesimal perturbation of these initial conditions led to infinitely different outcomes.

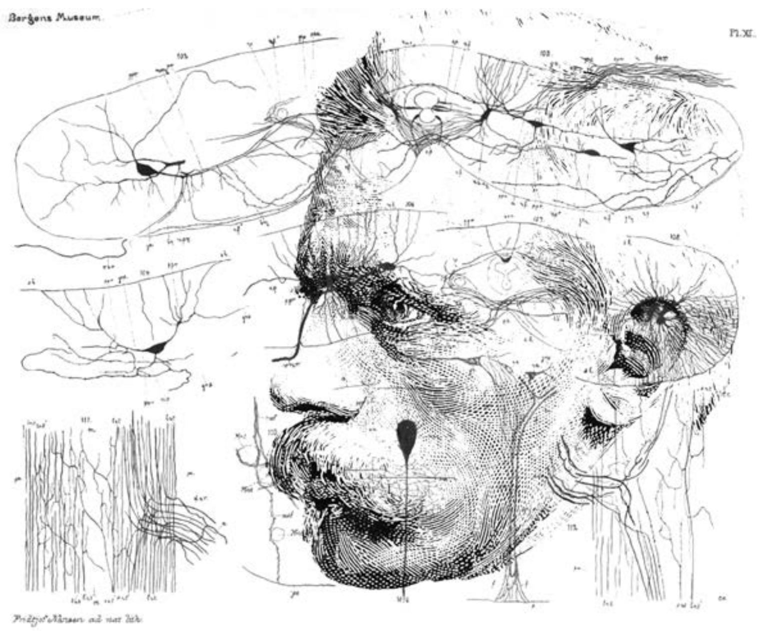


Figure 6.8. Collage[1] of nerves from the spinal cord of a hagfish "drawn [by Nansen] under the *camera lucida* as exact to nature as possible (very highly magnified)."[2] and Fridtjof Nansen himself.

[1] Adopted from http://neuroportraits.eu/portrait/fridtjof-nansen. © Professor Nicolas Wade. Used with permission.

[2] Fridtjof Nansen, *The Structure and Combination of the Histological Elements of the Central Nervous System*, J. Grieg, Bergen, 1887, *cf.* p. 114.

In recent years, the Laplace idea of imaginary and omnipotent intelligence went through an unexpected twist. Instead of thinking about an external intelligence, the thesis that the Universe is a giant computer was advanced in an attempt to reduce continuous physics to its digital counterpart. The ever insightful Richard Feynman observed[54]

> It always bothers me that, according to the laws as we understand them today, it takes a computing machine an infinite number of logical operations to figure out what goes on in no matter how tiny a region of space, and no matter how tiny a region of time. How can all that be going on in that tiny space? Why should it take an infinite amount of logic to figure out what one tiny piece of space/time is going to do? So I have often made the hypotheses that ultimately physics will not require a mathematical statement, that in the end the machinery will be revealed, and the laws will turn out to be simple, like the chequer board with all its apparent complexities.

Are we machines? – the anxious reader may ask. The answer depends on perspective. Eugene Wigner, the Hungarian-American theoretical physicist, supported the notion that if predictability is accepted as a necessary condition for being a machine, then we are not machines. However, Francis Crick, the English molecular biologist in the book *The Astonishing Hypothesis: The Scientific Search for the Soul* informed us that[55]

> 'You,' your joys and your sorrows, your memories and your ambitions. Your sense of personal identity and free will, are in fact no more than the behaviour of a vast assembly of nerve cells and their associated molecules

Crick suggests that the presence of some unspecified emergent property of a great number of nerve cells makes us capable of thinking. Thus according to Crick, the emergent phenomenon implies that "while the whole may not be the simple sum of the separate parts, its behavior can, at least in principle, be *understood* from the nature and behavior of its parts *plus* the knowledge of how these parts interact." It is a very attractive, thoughtful, all-purpose thesis. The stability of dynamical systems depends on so-called Lyapunov exponentials, and the sum of them classifies spatiotemporal evolution of the system.

The above remarks bring us to the fundamental differences between prediction and modeling. The distinctions are rather clearly drawn in computational learning theory.[56] But roughly, the difference is that prediction of the goal is to produce the best guess of future behavior, *by any means whatsoever*; in contrast with modeling the goal, which is to learn something about the process's structure. Naturally, prediction is aided by means of a good model. But typically, efforts at prediction allow for any sort of representation, as long as it gives *good* forecasts. Therefore, by looking at any tables, or in our case Dr Simpson's *Terra Nova Expedition* meteorological tables, one in search of determinism can hope to make good predictions. These predictions can be intuitive, as in a wise man's case, or more elaborate and founded, as in the case of various scientific methods of prediction. These scientific methods are usually implemented on computers which run diverse prediction algorithms.

I have already mentioned about the meteorologically insightful works of Vilhelm Bjerknes and Lewis Fry Richardson in the early part of the twentieth century. In their case, prediction of meteorological events was directly related to spatiotemporal solutions of specific differential equations, which were describing the meteorological system under consideration.

Returning to Francis Crick's thesis, one can notice that its roots are in the development of neuroscience. It was "our" Fridtjof Nansen who pioneered research into the nature of nervous cellular units. In 1887, Dr Nansen in the paper entitled *The Structure and Combination of the Histological Elements of the Central Nervous System* published a summary of his work, and later the same year submitted its abbreviated Norwegian version to obtain a PhD degree. Dr Nansen's thesis was "We are obliged to abandon the theory of the direct combination of the ganglion cells."[57] It was indeed a revolutionary concept that nerve cells, or as we call it now the neuron[s], were autonomous units of the human central nervous system. Unfortunately for neuroscience, but fortunately for polar exploration and science, in general Dr Nansen did not actively continue his interests in studies of nerve cells. During the time when Dr Nansen was pursuing his polar adventure and political career, neuroscience witnessed rapid development, which continues to this day. In parallel to biologically

related neuroscience, the development of the notion of *connectionism* was the subject of intense studies. For some, connectionism stood as an independent concept, and for others as a reformulated description of the interactions studied in physics under the notion of physical fields and interactions.

Although the human central nervous system has been studied by medical doctors ever since the late Middle Ages, its detailed structure began to be unraveled only a century ago. In the second half of the nineteenth century, two schools contended for scientific prevalence: the *reticularists* claimed that the nervous system formed a continuous, uninterrupted network of nerve fibers, whereas the *neuronists* asserted that this neural network is composed of a vast number of single, interconnected cellular units, the neurons. As often in the course of science, the struggle between these two doctrines was gradually decided by the advent a new technique, invented by Camillo Golgi around 1880, for the staining of nerve fibers by means of a bichromate silver reaction. This technique was ingeniously applied by the Spanish doctor Santiago Ramon y Cajal in 1888 to disprove the doctrine of reticularism by exhibiting the tiny gaps between individual neurons.

While the dendrites serve as receptors for signals from adjacent neurons, the axon's purpose is the transmission of the generated neural activity to other nerve cells or to muscle fibers. In the first case, the term *interneuron* is often used, whereas the neuron is called a *motor neuron* in the latter case. The third type of neuron, which receives information from muscles or sensory organs, such as the eye or ear) is called a *receptor neuron*.

The joint between the end of an axonic branch, which assumes a plate-like shape, and another neuron or muscle, is called a *synapse*. At the synapse, the two cells are separated by a tiny gap of only about 200 nm (nanometer) wide (the *synaptic gap* or *cleft*), barely visible to Ramon y Cajal, but easily revealed by modern techniques. Structures are spoken of in relation to the synapse as *presynaptic* and *postsynaptic*, *e.g.* postsynaptic neuron. The synapses may be located either directly at the cell body, or at the dendrites of the subsequent neuron, their strength of influence generally diminishing with increasing distance from the cell body. The total length of neurons shows great variations: from 0.01mm for interneurons in the human brain up to 1m for neurons in the limbs.

Nervous signals are transmitted either electrically or chemically. Electrical transmission prevails in the interior of a neuron, whereas chemical mechanisms operate between different neurons, *i.e.* at the synapses. Electrical transmission is based on an electrical discharge, which starts at the cell body and then travels down the axon to the various synaptic connections. In a state of inactivity, the interior of the neuron, the protoplasm, is negatively charged against the surrounding neural liquid. This resting potential of about –70 mV is supported by the action of the cell membrane, which is impenetrable for Na^+ ions, causing a deficiency of positive ions in the protoplasm (see Fig. 6.9).

Signals arriving from the synaptic connections result in a transient weakening or depolarization of the resting potential. When this is reduced below –60 mV, the membrane suddenly loses its impermeability against Na^+ ions, which enter into the protoplasm and neutralize the potential difference, as illustrated in the left part of Fig. 6.9. This discharge may be so violent that the interior of the entire neuron even acquires a slightly positive potential against its surroundings. The membrane then gradually recovers its original properties and regenerates the resting potential over

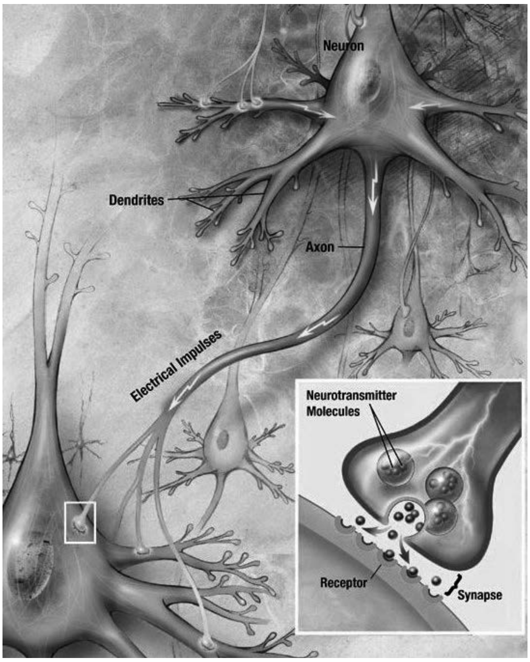


Figure 6.9. Illustration of neural electrical signal propagation along an axon to the cell body and the next cell dendrites. Taken from Wikipedia (http://en.wikipedia.org/wiki/Neuron).

a period of several milliseconds. During this recovery period, the neuron remains incapable of further excitation. When the recovery is completed, the neuron is in its resting state and can "fire" again. The discharge, which initially occurs in the cell body, then propagates along the axon to the synapses (see Fig. 6.9 (right part)). Because the depolarized parts of the neuron are in a state of recovery and cannot immediately become active again, the pulse of electrical activity always propagates in one direction: away from the cell body. Since the discharge of each new segment of the axon is always complete, the intensity of the transmitted signal does not decay as it propagates along the nerve fiber.

The speed of propagation of the discharge signal along the nerve fiber also varies greatly. In the cells of the human brain, the signal travels with a velocity of about 0.5–2 m/s. While this allows any two brain cells to communicate within 20–40 ms, which is something like a temporal quantum in the entire operation of the human central nervous system, it would cause an unacceptably long reaction time for peripheral neurons connecting brain and limbs: a person would hit the ground before even knowing that he had stumbled. To increase the speed of propagation, the axons for such neurons are composed of individual segments that are covered by an electrically insulating myelin sheath, which is interrupted from time to time at the so-called Ranvier nodes. The presence of an insulating cover causes the signal to propagate along the axon as in a waveguide from one Ranvier node to the next, triggering almost instantaneous discharge within the whole myelinated segment. This mode of propagation, called *saltatory conduction*, allows for transmission velocities of up to 100 m/s.

Under which condition is the postsynaptic neuron stimulated to become active? Although in principle a single synapse can inspire a neuron to “fire”, this is rarely so, especially if the synapse is located at the outer end of a dendrite. Just as each axon sends synapses to the dendrites and bodies of a number of downstream neurons, so is each neuron connected to many upstream neurons which transmit their signals to it. The body of a neuron acts as a kind of “summing” device which adds the depolarizing effects of its various input signals. These effects decay with a characteristic time of 5–10 ms, but if several signals arrive at the same synapse over such a period, their excitatory effects accumulate. A high rate of repetition of the firing of a neuron, therefore, expresses a large intensity of the signal. When the total magnitude of the depolarization potential in the cell body exceeds the critical threshold (about 10 mV), the neuron fires. Therefore, the influence of a given synapse depends on several aspects: the inherent strength of its depolarizing effect, its location with respect to the cell body, and the repetition rate of the arriving signals. There is a great deal of evidence that the inherent strength of a synapse is not fixed once and for all. As originally postulated by Donald Hebb[58], the strength of a synaptic connection can be adjusted, if its level of activity changes. An active synapse, which repeatedly triggers the activation of its postsynaptic neuron, will grow in strength while others will gradually weaken.[59] This mechanism of synaptic plasticity in the structure of neural connectivity (known as Hebb’s rule) appears to play a dominant role in the complex process of learning.

For a present day person, the above description without a doubt would suggest that the human nervous system is working in a digital-like fashion, *all-or-nothing*. A natural question arises: could we use a digital computer to mimic human nervous system? Could we let a computer think, and thus create an Artificial Intelligence with all its consequences[60]

> Dave: *Hello, HAL. Do you read me, HAL?*
> HAL: *Affirmative, Dave. I read you.*
> Dave: *Open the pod bay doors, HAL.*
> HAL: *I’m sorry, Dave. I’m afraid I can’t do that.*
> …
> Dave: *HAL, I won’t argue with you anymore! Open the doors!*
> HAL: *Dave, this conversation can serve no purpose anymore. Goodbye.*
> …
> HAL: *Dave, stop. Stop, will you? Stop, Dave. Will you stop, Dave? Stop, Dave. I’m afraid. I’m afraid, Dave. Dave, my mind is going. I can feel it. I can feel it. My mind is going. There is no question about it. I can feel it. I can feel it. I can feel it. I’m a … fraid. Good afternoon, gentlemen. I am a HAL 9000 computer. I became operational at the H.A.L. plant in Urbana, Illinois on the 12th of January 1992. My instructor was Mr. Langley, and he taught me to sing a song. If you’d like to hear it, I can sing it for you.*

or in Frankenstein’s lament[61]

> *I have devoted my creator, the select specimen of all that is worthy of love and admiration among men, to misery; I have pursued him even to that irremediable ruin. There he lies, white and cold in death.*

Can a machine think? Ever since Alan Turing's work on Computing Machinery and Intelligence,[62] many have pondered the question "Can a machine pass for a human in an imitation game?"

Although the answers to the above questions are (as of today) negative, certain important iterations toward Artificial Intelligence were developed and presented. Namely, the development of an *artificial* neural network raised high hopes.

An artificial neural network, usually just called a *neural network*, is a computational model that tries to mimic the structure and/or function of biological neural networks. Thus, a neural network consists of a large number of units joined together in a pattern of connections. Units called neurons in a net are usually segregated into three classes: input units which receive information to be processed, output units where the results of the processing are found, and units in between called hidden units. If a neural net were to model the whole human nervous system, the input units would be analogous to the sensory neurons, the output units to the motor neurons, and the hidden units to all other neurons. These neural networks are massively parallel in nature, just as the brain is, but not in the sense of traditionally parallel computer designs. Neural networks are not programmed with a computer language the way conventional computers are, but are literally trained to behave in the way we want them to.

I have already mentioned about by Donald Hebb's rule discovered in 1949, which is not mathematically precise. However, its variations are possible and indeed used in many applications. In the most simple case, Hebb's rule demands that the change Δw_{AB} of a weight w_{AB} between a neuron A projecting to neuron B is proportional to the average firing rate ϑ_A of A and ϑ_B of B, *i.e.*, $\Delta w_{AB} = \varepsilon\vartheta_A\vartheta_B$ with the constant ε. Thus, the self-organizing method for a neuron's firing to become better and better correlated with a cluster of stimulus patterns is prescribed by Hebb's rule. The rule associates input and output patterns or their similarities approximated with the best possible accuracy.

One may notice that Hebb's learning rule is in fact an application, at the level of single neurons, of the pioneering work of Ivan Pavlov on coincidence training. Pavlov knew, as does everyone that has ever owned a dog, that when a dog is presented a food stimulus, a strong salivatory response is elicited. Pavlov in 1927 showed that he could train dogs to associate a neural stimulus, such as for example the ring of the bell, with the food stimulus. The basic idea behind the Hebb rule is quite similar: strengthen the connections of neurons that fire together. Thus, the firing of a single neuron will stimulate the other neuron to fire as well. Obviously, this is one of the many paradigms of the learning process,[63] and thus one of many neural network training rules.

Since Hebb's work, many refinements of learning rules have been developed. In particular, the most successful and certainly one of the most studied learning systems in the neural network area is backward error propagation learning, or as more commonly known, back-propagation. Researchers have used this method in a great number of applications ranging from speech recognition and playing games to prediction of time series. There is a large body of literature related to neural networks, including more than one hundred books and several hundred thousand scientific publications.

Years ago,[64] with my two colleagues I personally developed and used a back-propagation neural network to predict solutions of the quantum mechanical Schrödinger equation. In Chapter 7, I will use a back-propagation network to investigate the weather conditions during Captain Scott's *Terra Nova Expedition*.

In more general terms, the traditional rule-based and analytical approaches (like the Laplace demon) to complex systems are flawed, and novel ways of studying complex systems are needed. This suggests that 'distributed' modeling and analyzing techniques pose some of the characteristics of complex systems and, therefore, hold more promise than rule-based methods. Towards the end of the last century, great interest and research have been presented in the analysis of complex systems. In particular, methods of the neural network, genetic algorithms, and cellular automata were developed. Here, I will continue with the application of neural network analyses of the weather events in Antarctica. However, one should be aware that an application of the two aforementioned methods is only for the brave.

6.6.3. Artificial Neural Network

Interest in using Artificial Neural Networks (ANNs) for prediction and forecasting has led to a tremendous surge in research during the last two decades of the last century. The research was driven by the direct applicability of neural networks in almost every human activity ranging from stock market prediction and handwritten character recognition to weather prediction, and many, many more.[65]

The interest was devoted to understanding how the past values of a given time series with temporal ordering may influence future values of this temporally ordered series, provided that the time series is resulting from forces driving the process generating the time series. These forces may be characterized by cycles, trends, and non-stationary properties. Thus, the objective of ANNs is to map the input data to output data. For example, the input data may be a series of temperatures and the output may be the next temperature in this series. Hence, in a still unspecified way, ANNs implemented in either software and/or hardware relate their input data with the desired output data. One would say that the main task of ANNs is to learn how to respond (with output data) to input data. Thus, the best possible estimations of the correct output data take place. The input and output data are connected by processing units called neurons, which due to their changeable interconnections (weights, w_{AB}) are capable of mapping the inputs and outputs.

One would expect that there are numerous ANN architectural designs which may fulfill the desired tasks. From the perspective of how the ANNs are trained to acquire their predictive powers, one can distinguish three learning classes:

- Supervised learning,
- Reinforcement learning,
- Unsupervised learning.

I will not comment on the second and the third learning classes, but instead focus on the first, supervised learning. In the case of supervised learning, the ANN output targets are known during training, and the error is understood as the difference between the desired target and the actual output. The error is fed back to the ANN for the next learning iteration. The purpose of following learning iterations is to reduce the error to its minimum value.

A great number of scholarly papers (numbering in the thousands) have been published in relation to applications of ANNs to meteorology. The most important

features of the ANN modeling technique for the understanding of complex meteorological systems can be summarized in the following way

- Neural networks conserve the complexity of the weather events they model because they have complex structures themselves,
- Neural networks encode characteristics of weather events in distributed form,
- Neural networks have the capacity to self-organize their internal structure through non-linear interactions and learning rules.

Arguably, the most successful and the most studied learning class is the above mentioned supervised learning, which is characterized by backward error propagation learning and the back-propagation network associated with it.[66]

The back-propagation network always has an input layer, an output layer, and at least one hidden layer. There is no theoretical limit on the number of hidden layers, but typically there will be one or two. The same comment is also valid for the number of neurons in the input, output, and hidden layers. Therefore, one is left with the requirement to perform experiments with different architectures of back-propagation ANN. While experimenting with ANNs, one is looking for a network which gives the best performance within a given set of meteorological data. Thus, by changing the number of neurons, layers, and transfer functions, one can find the ANN of which the difference between the forecasted and actual meteorological variable is the smallest possible.

6.6.4. The Back-propagation ANN Algorithm

Let us look at time series prediction by a back-propagation ANN in more detail. An example scheme of the ANN supervised learning process is depicted on Fig. 6.10. Actually, the back-propagation ANN depicted on this figure is exactly the network

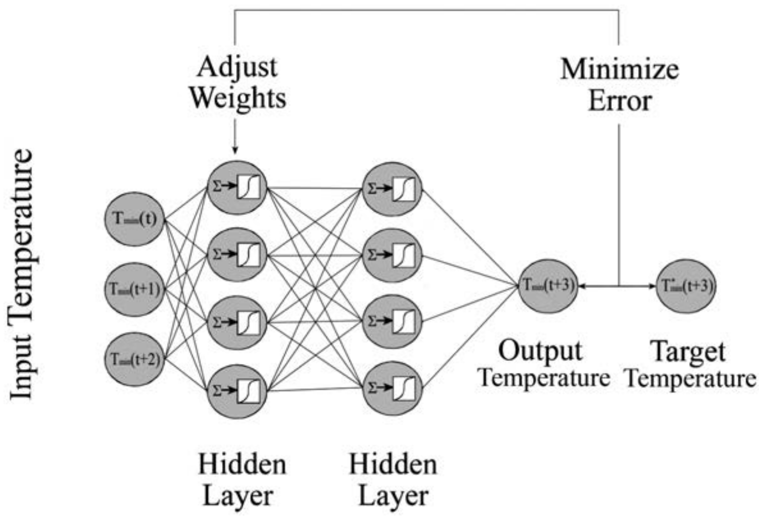


Figure 6.10. The architecture of the back-propagation ANN used by the author in this book.

that will be used in the next chapter to retrodict the daily minimum temperatures encountered by the Captain Scott party back in February through to March 1912, while sledging on the Barrier.

The back-propagation ANN presented in Fig. 6.10 based on its performance measured by absolute error retrodiction. It was selected from many different networks consisting of a different number of input and hidden layer neurons. In the case of use of a back-propagation ANN, it is an essential procedure to find the best performing network structure out of many different network architectures. In my case, and for daily minimum near surface data from Antarctica, I found that the back-propagation ANN consisting of three input neurons and two hidden layers each consisting of four neurons each gave the smallest absolute error.

At each instance, the training time series presented to a back-propagation network is numerically processed in two stages. During the first stage, the input time series presented to the network generates a forward flow of neural activity from input to output neurons. In the second stage, the errors, which can be understood as differences between the network and the desired (target) values of time series, generate a flow of data from the output layer backward to the input layer. The process described above represents the first iteration. In the second iteration, sometimes called epoch, the error obtained in the first iteration is used to modify the weights of the interconnections of the network, and the whole epoch is repeated. The way that the weights of neural interconnections are implemented is such that the final ANN error should reach a minimum. It is rarely achievable that the error is nil.

Thus, in addition to the above-mentioned iterations, one also has to design the ANN architecture by specifying the number of neurons in all layers. The investigative reader may easily notice that the training of the ANN is indeed a procedure which resembles the optimization procedure of its stochastic weights. Every explorer faces the question of multivariable (distance, velocity, rations, weight, *etc.*) optimization. A general algorithm of ANN training for a given neural architecture is as follows:

1. Define a cost function of which one is desired to minimize,
2. Define a transfer function for neurons,
3. Define network performance measurement,
4. Start the first iteration and initialize the network weights,
5. Propagate training time series through the network and compare calculated and target values,
6. Calculate derivative of the error with respect to the activation,
7. Calculate derivative of the activation with respect to the net input,
8. Calculate derivative of the net input with respect to a weight,
9. Update all weights in the network by adding the delta weights to the corresponding previous weights as set in point 4,
10. Continue iterations until the total error is smaller than the final target error, and then stop.

In other words, the ANN is forced to train until the total error falls to less than or equal to a pre-determined value. Of course, this pre-determined error may be set to an arbitrary value. However, in practice one is looking to find the smallest possible error for a given ANN architecture.

In practice, I presented to the input neurons sequences of equally spaced samples of McMurdo daily minimum temperatures $T_{min}(t)$, $T_{min}(t + 1)$, $T_{min}(t + 2)$, where t stands for a particular Julian day considered in this period of time. The output neuron was assumed to be the desired retrodiction daily minimum temperature from the respective Schwerdtfeger and Elaine automated weather station data. After the network reached its maximum performance for the given set of data, I shifted $t \rightarrow t + 1$ and repeated the learning procedure. Thus, in such a way I have obtained three fully trained neural networks for the retrodiction of minimum daily temperatures at the geographical coordinates of the mentioned weather stations.

Even better results for a back-propagation ANN was obtained if the output temperature was expressed not with actual minimum temperature, but with the temperature *difference* between the McMurdo and Schwerdtfeger stations.

Although there have been numerous scholarly papers devoted to understanding the general relationship between the neural networks' approximation capacity and its architecture (number of layers and neurons), in reality one is left with the need to experiment with not only the training, but also with designing different architectures and comparing their ability to perform the assigned task of forecasting.

Finally, one has to observe that the back-propagation ANN has been used in countless applications to predict the time series of many different variables like finance time series, solar radiation, air temperature, *etc*.

In Chapter 7, I will use the back-propagation ANN to analyze modern and historical temperature records along Captain Scott's route across the Barrier. However, it must be stressed that I will not attempt to predict the minimum daily temperature at the given location using past temperature records at the same location. I will look at the problem a little differently using a more tractable prediction. I will attempt to predict daily minimum temperatures in the vicinity of One Ton Depôt, using minimum temperatures at McMurdo station recorded at *the same time*. Therefore, the back-propagation ANN will be forced to find an unspecified relationship between the daily minimum temperatures at the vicinity of One Ton Depôt (Schwerdtfeger weather station) and the McMurdo Station.

6.7. Synopsis

In this rather technical chapter, I have presented a fairly detailed analysis of historical and modern temperature records directly related to Captain Scott's journey across Antarctica. This analysis was necessary for at least two reasons. The first was to find and account for possible errors in temperature and wind velocity data, historical and modern. The second was to describe data sources, data acquisition, and analysis methods. This description serves and supports future research on the subject, and allows for repetitive experimentation on the subject.

Chapter 7

February 27th through March 27th, 1912 – Extreme Cold Snap?

The captain had been telling how, in one of his Arctic voyages, it was so cold that the mate's shadow froze fast to the deck and had to be ripped loose by main strength. And even then he got only about two-thirds of it back.

Mark Twain[1]

But they [computers] *are useless. They can only give you answers.*

Pablo Picasso[2]

In this and the following chapter, I will present and argue my main thesis, which is that in late February and March 1912, Lt Bowers and Captain Scott fabricated meteorological data. This fabricated data includes near surface temperatures and wind velocities. In addition, I will show that Captain Scott also lied about wind strength and duration and fuel shortage during the return stage to One Ton Depôt.

The preceding chapters served only as a lengthy introduction, and I hope this will help the readers to understand the results of analyses of meteorological records reported by Captain Scott and Lt Bowers at the end of February through to March 1912.

Actually, my research presented in the preceding chapters represents an important part of the scientific method, which I applied to investigate the question of weather conditions reported by Lt Bowers and Captain Scott in late February and March 1912.

Although much interest and work was and is devoted into describing and understanding the *scientific method*, there is no uniform and universal view. The differences exist in interpreting minute details of the scientific method. However, in general, terms the following steps are clearly identified[3]

- Formulate a question,
- Perform background research,
- Construct a hypothesis,
- Test hypothesis by doing an experiment,
- Analyze data and draw a conclusion,
- Communicate results.

The purpose of scientific inquiry is to gain knowledge from *testable* explanations of observed phenomenon. Obtained knowledge must be capable of predicting the

results of future observations and experiments. Every hypothesis tested is an attempt to falsify it, or to refute it[4]

> Every 'good' scientific theory is a prohibition: it forbids certain things to happen. The more theory forbids the better it is … A theory which is not refutable by any conceivable event is non-scientific. Irrefutability is not a virtue of a theory (as often people think) but a vice … the criterion of the scientific status of the theory is its falsifiability, or refutability, or testability.

Thus, the scientific method assures that any given hypothesis can be tested by others. The process of testing and re-testing is the difference between scientific and all-unscientific beliefs and biases. It shows the difference between a scientific and an unscientific method when describing reality.

On Sep. 23rd, 2011, the researchers from the European Organization for Nuclear Research (CERN) presented results[5] of a historically important experiment that detected neutrinos moving faster than the speed of light. It was a bombshell announcement. If true, it would change the fundamentals of physics.

The result prompted a worldwide discussion, comments, and analyses, not only from physicists.[6] The labs at Japan's T2K and America's Fermilab started preparations to re-run (test) CERN's experiment. Also the CERN group of about 190 researchers [*sic*] went to re-test their results. Not long after they began, the group found that a fiber optic cable was attached improperly and that a clock oscillator was ticking too fast. Thus, through additional tests, an anomalous result showing neutrinos arriving earlier than expected was not confirmed, and the source of error was found.

One would say that CERN's group prematurely rushed the announcement of their results questioning the fundamentals of physics. However, to err is a human trait.

This neutrino example, out of many, shows how the scientific method works, provided that the researcher is willing to apply it.

From my previous chapters, one can notice that at no instance was the scientific method used in answering questions related to the *Extreme Cold Snap* reported by Captain Scott. Not only was the scientific method *not* used, but also the authors – starting with Dr Simpson and ending with Dr Solomon – created an impressive number of counterfactuals, fallacies, and even data fabrication. It appears that due to these authors' manipulations and/or whoppers the readers of their revelations have fallen into a cognitive bias. In particular, as I described in Chapter 4, Dr Solomon went way too far with her wisdom and crossed the Rubicon of scientific integrity by fabricating and falsifying meteorological data.

In this chapter, I will show my approach to finding out the weather conditions during the final weeks of Captain Scott's journey. I will use the scientific method of the predictive capacity of artificial neural networks as described in the previous chapter. Obviously, as with any scientific tool the artificial neural network has its advantages and pitfalls. However, it has one of the most important advantages in that it can produce *testable* results. Thus, I will get a disciplined insight into testable meteorological variables as for example near surface minimum temperatures.

Various parts of this chapter have been previously published in a peer-reviewed scientific journal.[7]

7.1. Extreme Cold Snap Hypotheses

Thus, returning to the above-mentioned steps of the scientific method, let me state in an explicit way my working Extreme Cold Snap Hypothesis

Extreme Cold Snap Hypothesis

As reported by Lt Bowers and Captain Scott on February 27th through March 19th, 1912, the minimum daily and the lowest near surface temperatures are accurate and true.

Alternatively and in a more compact form the above Extreme Cold Snap Hypothesis

$$\text{A string of}\left\{\frac{\text{Temperature }[°\text{F}]}{\text{Feb. }27^{\text{th}}\text{ through Mar. }19^{\text{th}}\text{, 1912}}\right\}\text{ is accurate and true.}$$

The following is a string of minimum or the lowest near surface temperatures reported by Lt Bowers and Captain Scott and appearing in the above Extreme Cold Snap Hypothesis[8]

$$\left\{\frac{-36}{\text{Feb. 27}},\frac{-41.5}{\text{Feb. 28}},\frac{-37.5}{\text{Feb. 29}},\frac{-41.2}{\text{Mar. 1}},\frac{-40.3}{\text{Mar. 2}},\frac{-41}{\text{Mar. 3}},\frac{-24}{\text{Mar. 4}},\frac{-38}{\text{Mar. 5}},\frac{-38}{\text{Mar. 7}},\frac{-45}{\text{Mar. 8}},\frac{-46.2}{\text{Mar. 10}},\frac{\mathbf{-37}}{\text{Mar. 13}},\frac{\mathbf{-43}}{\text{Mar. 14}},\frac{\mathbf{-40}}{\text{Mar. 17}},\frac{\mathbf{-35}}{\text{Mar. 18}},\frac{\mathbf{-40}}{\text{Mar. 19}}\right\}\frac{[°\text{F}]}{1912}$$

A number of times throughout this book, I did say that on Mar. 10th, 1912 the minimum temperature thermometer was broken by Lt Bowers, and since that day the temperatures recorded by the party *were not minimum* temperatures, but readings obtained by Captain Scott using his personal thermometer. This important fact was indicated by giving temperature entries in the above string in boldface.

If the above chain of temperatures reported by Lt Bowers and Captain Scott may be called the *Extreme Cold Snap* Hypothesis, then what follows from Captain Scott's letter written in late March 1912 to Kathleen Scott must be called the *Super Extreme Cold Snap*.

In his letter to Vice-Admiral Sir Francis Charles Bridgeman, Captain Scott after ending the main address remarks as a summary of the *Extreme Cold Snap* [9]

> Excuse writing – it is –40°, and has been for nigh a month [*sic*].

In a touching letter to his wife, Captain Scott makes one reference to the *Super Extreme Cold Snap*[10]

> Dear it is not easy to write because of the cold –70 degrees below zero [*sic*] and nothing but the shelter of our tent …

Thus, we have to add the above two temperature data measurements to Captain Scott's meteorological record. Since no specific dates are given when the letters were written, one has to consider them in context to guess approximate dates.

Since the *Extreme Cold Snap* started on Feb. 27th, 1912, it is easy to conclude that in the case of the letter to Sir Francis that Captain Scott estimates that the temperature –40°F persisted at least during the night until Mar. 27th, 1912. Given that this –40°F figure almost confirms the *Extreme Cold Snap* hypothesis Feb. 27th through Mar. 19th, 1912, it is rational to assume that this temperature (–40°F) persisted at least during the night from Mar. 20th through to Mar. 27th, 1912. In view of the fact that the Party's minimum temperature thermometer was broken on Mar. 10th, I assume that the temperature –40°F, given by Captain Scott, was the *lowest* temperature reported.

The estimation of when Captain Scott recorded –70°F can be made on the basis of his description given in the letter. Before mentioning –70°F, Captain Scott wrote, "We have gone down hill a good deal since I wrote the above … we are now only 20 miles from a depot but we have very little food or fuel." Since from his journal we know that the Party was "21 miles from the depot" on Mar. 18th, it is safe to assume that Captain Scott recorded –70°F on Mar. 18th, 1912. Let us assume that the temperature –70°F say was recorded by Captain Scott after midnight of Mar. 17th/18th, 1912 and Mar. 18th is assigned to this temperature.

Therefore, from Captain Scott's data I can formulate the Super Extreme Cold Snap Hypothesis in the following way

Super Extreme Cold Snap Hypothesis

A string of

$$\left\{\frac{\text{Temperature }[°\text{F}]}{\text{Feb. 27 – Mar. 19, 1912}}\right\}+\left\{\frac{\mathbf{-70}}{\text{Mar. 18}},\frac{\mathbf{-40}}{\text{Mar. 19}},\frac{\mathbf{-40}}{\text{Mar. 20}}\text{ through }\frac{\mathbf{-40}}{\text{Mar. 27}}\right\}\frac{[°\text{F}]}{1912}$$

is accurate and true.

Now, what follows is a test of the above hypothesis. It is a post-modernistic notion that everyone has a theory; a valid theory about almost everything. Voodoo priests sacrificing chickens to please the spirits of the dead and all sorts of cultists are working with a certain theory. However, I will not venture hastily into the theory whose testing and re-testing capacity is nil. Instead, I will present analyses within the scientific realm. This will ensure that investigative readers could by themselves repeat (my results) and thus falsify the *Extreme Cold Snap* and *Super Extreme Cold Snap* Hypotheses.

The question arises: how today, some 100 years later, can one prove and disapprove these Hypotheses? How can one get insight into actual near surface temperatures during late February and March 1912?

It is not surprising that it was Dr Simpson, the *Terra Nova Expedition*'s meteorologist, who proposed and investigated the method of getting insight into the Barrier temperatures from *simultaneously* recorded temperatures at Cape Evans. We know from Chapter 3.2 that Dr Simpson suggested that an unspecified relationship exists between the Barrier and Cape Evans temperatures. This relationship was revealed by Dr Simpson in his hand drawing, as shown on Fig. 3.11, where the difference between temperatures on the Barrier and at Cape Evans is depicted.

We also know from my discussion presented in Chapter 3, concerned with Dr Simpson's analysis of Captain Scott's meteorological record of his journey to/from the South Pole, that due to tantamount of weather with climate, his results

were a rough approximation (see Fig. 3.13). Essentially, Dr Simpson's difficulty of his analysis was a lack of meteorological data and lack of the scientific method.

We also know from section 3.2 that to justify Captain Scott's temperature record during the *Extreme Cold Snap*, Dr Simpson fabricated an untrue notion[11]

> … that during these critical weeks the temperature at Cape Evans was abnormally low when compared with observations over five years …

Figs. 3.15 through 3.17 clearly illustrate that Dr Simpson was irrationally(?) departing from the truth, not only by saying that in 1912 temperatures at Cape Evans were abnormally low, but more importantly that Dr Simpson abandoned his own findings of temperature difference (gradient) between the coast and Barrier interior, see Fig. 3.11.

The investigative reader, after reading Chapter 4 where I examined Dr Solomon's fraudulent scientific data fabrication, should also notice that minimum daily near surface temperatures recorded at weather stations at McMurdo, Scott Base, and Schwerdtfeger located near the proximity of One Ton Depôt show similar behavior.

7.2. Orography-driven Weather at the Ross Ice Shelf

It was Dr George Simpson who noticed and described the peculiar weather feature characteristics of the Ross Ice Shelf area. In related research, which I described in section 1.3, it was shown that a well-defined Ross Ice Shelf air stream is observed. Dr Simpson's finding was depicted on Fig. 1.5.

Actually, the observed Ross Ice Shelf surface air stream flows northward along the Transantarctic Mountains. This air flow is more or less along the original route traveled by the Captain Scott party during the inward and outward journeys. It has been suggested that the near surface wind field at the Ross Ice Shelf consists of the katabatic winds, barrier winds, and winds associated with the passage of cyclones and mesocyclones. However, this artificial cataloging does not account for the self-organized criticality nature of winds in Antarctica, as discussed in section 1.4.

In this chapter, however, I am concerned with the possible relationships between daily minimum temperatures at different Ross Ice Shelf locations. The question of such a relationship between wind velocities will be addressed in the next chapter.

Let us look at climatic temperature changes during the whole year in Antarctica. Fig. 7.1 illustrates average daily minimum near surface temperatures recorded at the South Pole (Amundsen-Scott Station), Schwerdtfeger (One Ton Depôt), and Scott Base. Depicted temperature changes show a similar behavior; a short summer in December-January, a rapid cooling, and a long coreless winter. One should also notice that the range of fluctuations of daily minimum temperatures is rather small at the South Pole and is increasing towards the Ross Ice Shelf locations. An additional interesting feature of temperature changes depicted on this figure is that these changes at Schwerdtfeger (SCH) and Scott Base (SB) stations nicely track each other. Indeed, it is a coarse observation, and more detailed analysis is required.

Before looking at the details, let me also present a supplementary figure depicting the average daily minimum near surface temperatures recorded during the *Extreme Cold Snap* period, *i.e.* Feb. 27th through Mar. 19th, for all available years, using modern records. On Fig. 7.2, I collected the respective data from three weather stations

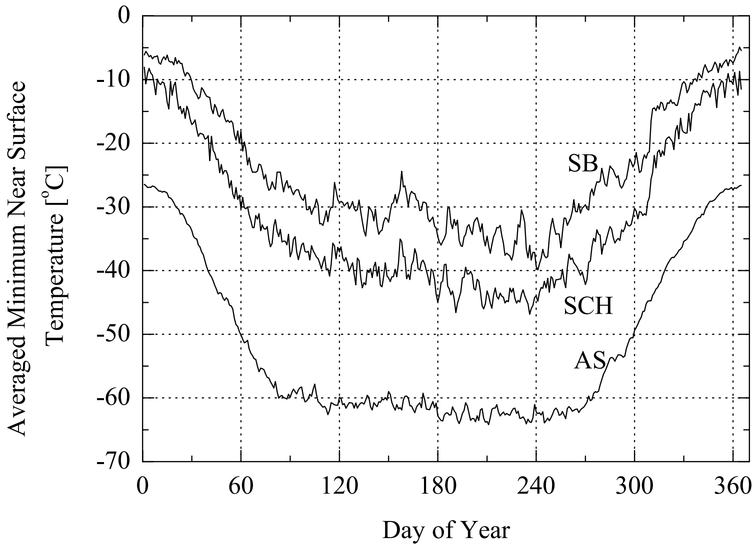


Figure 7.1. Average daily minimum near surface temperatures recorded at the South Pole Amundsen-Scott station (AS), Schwerdtfeger station (SCH) in the proximity of Captain Scott's One Ton Depôt, and New Zealand's Scott Base (SB) station, located at the Pram Point, Hut Point Peninsula, Ross Island.

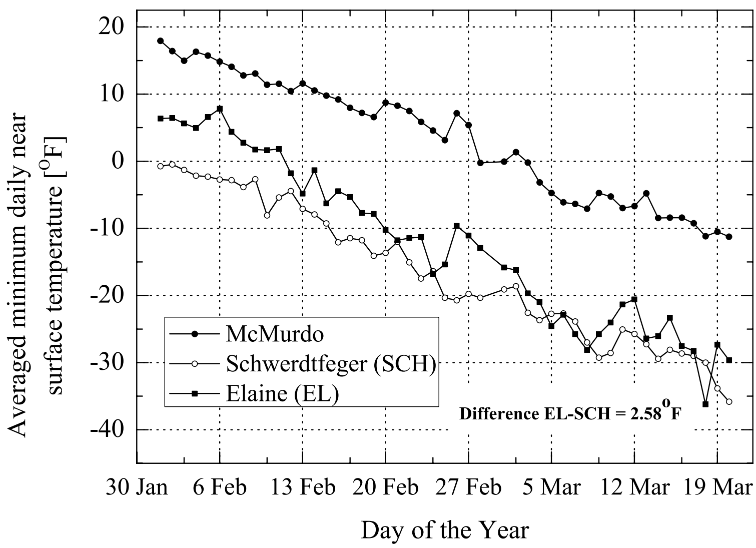


Figure 7.2. Averaged minimum daily near surface temperature from Feb. 1st through Mar. 19th at three different weather stations: McMurdo (•), Schwerdtfeger (○), and Elaine (■).

of interest: McMurdo, Schwerdtfeger, and Elaine. Again, one easily notices that the changes of temperature are tracking each other. One should also notice that although the Elaine station is located about 359 km further south than Schwerdtfeger station,

its minimum daily temperatures are close or very close to the former one. This may indicate that one should not expect that the minimum temperatures at the locations south of Schwerdtfeger station are *significantly* colder.

The investigative reader may rightly recall that Dr Simpson, in his fallacious account of explaining the *Extreme Cold Snap*, artificially divided the Ross Ice Shelf temperature changes into North and South of One Ton Depôt. According to Dr Simpson[12]

> We must assume that during the winter the south of the Barrier is colder then north, and therefore the cross for February may indicate the normal difference between the south of the Barrier and Cape Evans, but how can the cross for March be fitted into any reasonable curve? The position of this cross is to my mind the most conclusive evidence that Scott had abnormal temperatures, and that the Barrier could be traversed many times without again encountering such low temperatures so early in the year.

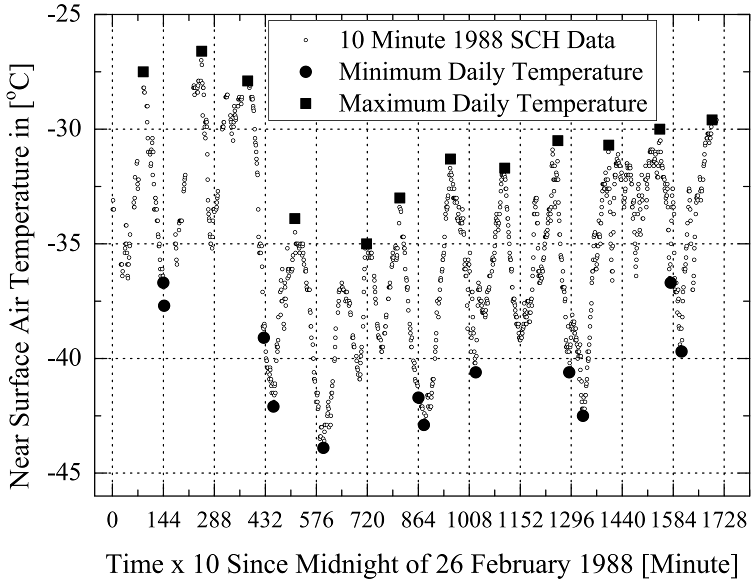


Figure 7.3. Near surface air temperature recorded at Schwerdtfeger weather station from midnight Feb. 26th, 1988. The temperature was recorded every 10 minutes for 24h periods. The actual measurement data is denoted by ○. Minimum and maximum daily temperatures are denoted by • and ▪, respectively.

From Fig. 7.2, one can see that the gradient of minimum temperatures south of Schwerdtfeger station (One Ton Depôt) is minimal if at all present. Having in mind the assumption of continuity of meteorological variables – conserved quantity – one observes that Dr Simpson's above thesis of a sudden decrease of temperatures south of One Ton Depôt is simply not true.

Minimum temperatures depicted on Figs. 7.1 and 7.2, are mathematical averages calculated over a certain time. The averaging procedure blurs important minute features of variable benign averages. Therefore, let us look at these changes in more detail.

Fig. 7.2 depicts the averaged daily minimum temperature change from Feb. 1st through Mar. 19th, at the McMurdo, Schwerdtfeger, and Elaine weather stations. Even though these two stations are approximately 229 and 588 km away from McMurdo, one can easily notice that some unspecified relationship of minimum temperature changes between these stations is present. A gradient in the minimum temperature at one station is followed by a similar change at another station and/or *vice versa*. Thus, the components of the gradient of minimum daily temperature, transform covariantly under changes of coordinates *i.e.*, the geographical coordinates of the Ross Ice Shelf. I do not imply that there is a mathematical rigorousness of the mentioned covariant transformation and/or linear relationship.

The correlation measured as the departure of minimum near surface temperature from statistical independence between McMurdo and Schwerdtfeger stations in the considered period of time is very high. Owing to intricate factors related to changes in the minimum temperature, I regard the observed correlations as very high.

However, before attempting to calculate the correlation coefficient (Pearson's correlation coefficient) as I already pointed out in Chapter 4 one has to look at the underlying distribution function of the variable under consideration. Without providing an answer to this vital question, any further considerations, and thus calculations of correlations are meaningless or simply erroneous.

However, even without detailed analysis of the underlying distribution function, one could wonder about the distribution functions of *extreme* values (maxima and/or minima) of a given temperature series. Is it possible that the distribution function of the daily minimum and maximum temperatures is Gaussian? The Gaussian case corresponds to the linear case described by patterns of dependence corresponding to bivariate normal distribution. However, we know from extreme value theory that one could consider two kinds of models for extreme value.[13]

On Fig. 7.3, I depicted near surface air temperature changes for 12 days, starting from midnight of Feb. 26th, 1988 and recorded by the Schwerdtfeger weather station. The temperature data were measured every 10 minutes. Occasionally the data is corrupted by a missing, limited string of temperatures. On this figure, I also depicted daily minimum and maximum temperatures.

Historically, the first model of extreme value was a model analyzing maximum or minimum values of variables measured over an extended period of recurrent time series'. The second group of models is called the peaks-over-threshold models. These are models where values of variables over an extended period of time exceed a certain high threshold.

Regardless of the method of analysis, it was shown that extreme values of a given time series are non-Gaussian distributed. I have already shown in Chapter 1 that the wind velocities in Antarctica are distributed according to a power-law distribution. In Chapter 4 Fig. 4.16 I have also shown that the distribution of minimum temperatures at given locations is non-Gaussian distributed.

I am addressing these remarks to avoid questions of not investigating the issues of classical statistical analysis of temperature data associated with the *Terra Nova Expedition*. The daily minimum and maximum temperatures depicted on Fig. 7.3 are not Gaussian distributed. Indeed, the studies of power-law cross correlations between different simultaneously recorded time series' in the presence of non-stationarity are in their infancy, and much work remains to be done to understand the subject.[14]

7.3. Artificial Neural Network Development and Testing

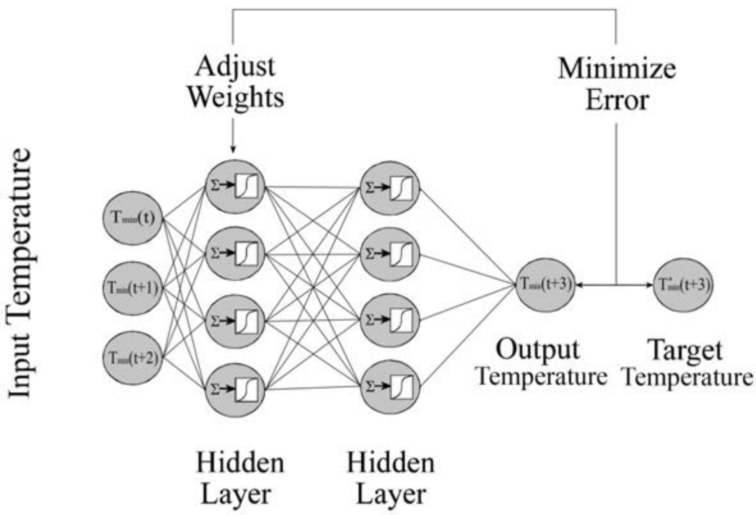
We are very fortunate that over the years, two automated weather stations named Schwerdtfeger and Elaine were installed in near proximity to Captain Scott's Pole party route. The data collected by these stations will provide a core element in *reconstructing* the weather conditions during Captain Scott's return from the Pole.

In the previous chapter, I have briefly outlined the general idea behind the predictive powers of artificial neural networks. In this section, I will present the development of an artificial neural network (ANN) toward predicting daily minimum temperatures at the location of Schwerdtfeger/Elaine weather stations *based on* entries of daily minimum temperatures at the location of McMurdo weather station.

The whole game with developing an ANN is to find a network which performs the best. An ANN's performance can be measured by its prediction precision. There is no theoretical prescription for the number of hidden layers and number of neurons in each layer. For practical reasons, one must examine a good number of different ANN architectures to find a network which approximates this task in the most precise way.[15]

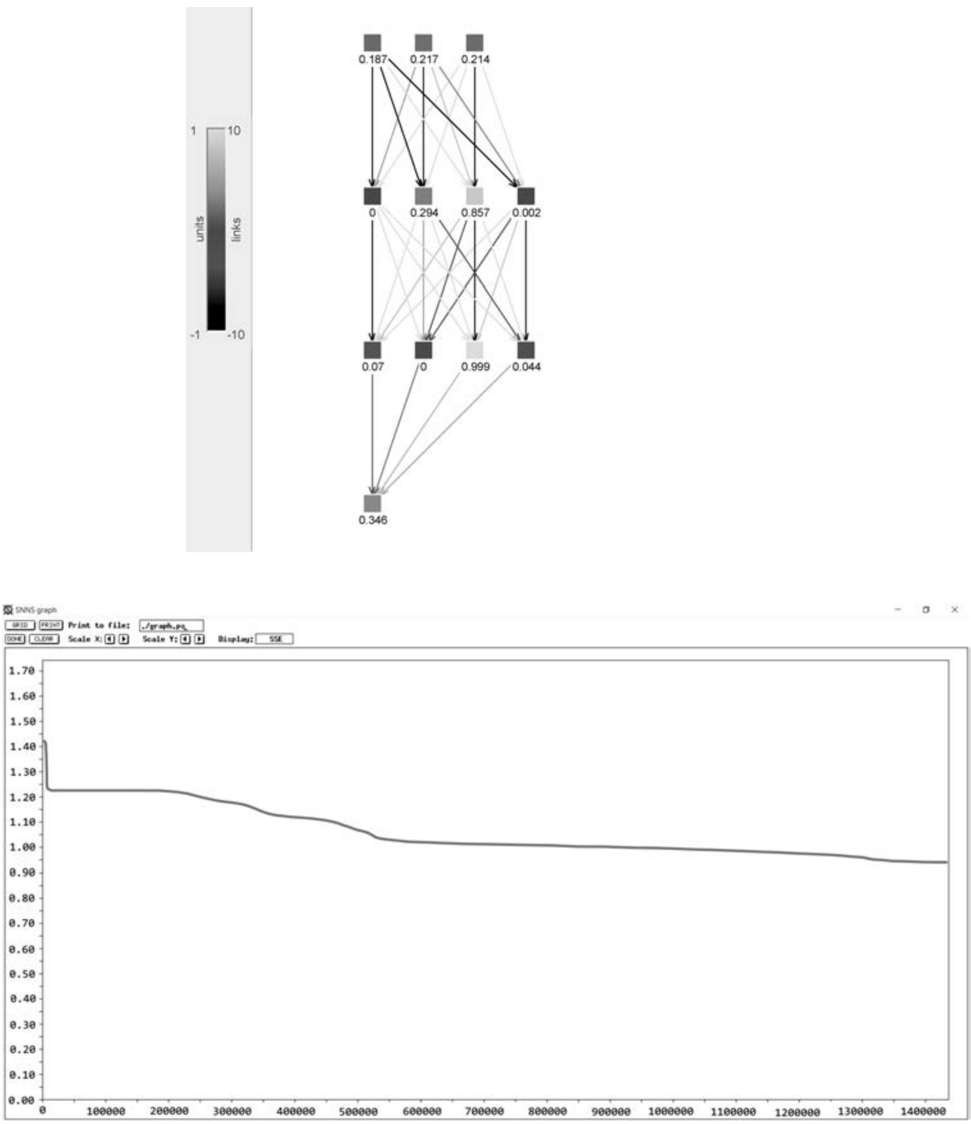
The neural network used in this chapter was a modified version of the neural network used by me in previous studies of solutions of the quantum mechanical Schrödinger equation.[16] While experimenting further with different configurations of the network, I have found that a network with 3 input neurons and 4 neurons in each of the first and second hidden layers, and 1 output neuron gave the best temperature prediction results. The architecture of the selected artificial neural network is depicted on Scheme 7.1.

The neural network was trained on sets of daily minimum temperatures in the following way. I presented to the input neurons a sequence of equally spaced samples of McMurdo daily minimum temperatures $T_{\min}(t)$, $T_{\min}(t+1)$, $T_{\min}(t+2)$, where t



Scheme 7.1. The architecture of the back-propagation artificial neural network used in this work.

stands for a particular Julian day considered in this work period of time, that is Feb. 27th through to Mar. 19th. The output neuron was assumed to be the desired retrodiction daily minimum temperature $T^*_{\min}(t+3)$ from the respective Schwerdtfeger station daily minimum temperature data. After the network reached its maximum performance for the given set of data, I shifted $t \to t+1$ and repeated the learning procedure. Thus, in such a way I have obtained a fully trained neural network for the *retrodiction* of minimum daily temperatures at the geographical coordinates of the Schwerdtfeger station.



Scheme 7.2. A snapshot of my computer screen illustrating the learning process of the artificial neural network used in my work.

The mean *absolute* retrodiction error $\langle \varepsilon \rangle$ was calculated from

$$\langle \varepsilon \rangle = \pm \frac{1}{N} \sum_{j=1}^{N} \frac{1}{n} \sum_{i=1}^{n} \left| T_{\mathrm{AWS}}^{(i,j)} - T_{\mathrm{ANN}}^{(i,j)} \right|,$$

where N is the number of years, n is the number of days. The minimum daily temperatures at the automated weather station (AWS) and retrodicted by the artificial neural network (ANN) are denoted respectively. The error ε ***is not*** the standard deviation of the sample of retrodicted minimum temperatures. It is the mean *absolute* retrodiction error.

To test the predictive power of the ANN for a given year and the period Feb. 27th through to Mar. 19th, the following procedure was developed. Out of a whole set of data (1985–2012)[17] used in the ANN training procedure, one year was deselected and thus not used. In other words, the ANN "did not see" daily minimum temperatures for the given year, and was fully trained by using the remaining set of temperature data. A typical snapshot of a computer screen during the final stages of the learning process is presented in Scheme 7.2.

Having fully trained the ANN, the network was presented with daily minimum temperatures recorded at McMurdo weather station and forced to calculate respective

Table 7.1. A summary* of my ANN's prediction of daily minimum temperatures absolute retrodiction errors $\langle \varepsilon \rangle$ obtained for listed years, for Feb. 27th through to Mar. 19th at Schwerdtfeger station. $\mathrm{McM} \xrightarrow{\text{Retrodiction}} \mathrm{SCH}$. The average absolute error was obtained for N = 21.

Year	Absolute Retrodiction error $\langle \varepsilon \rangle_{\mathrm{McM} \to \mathrm{SCH}}$ in [°F]	Year	Absolute Retrodiction error $\langle \varepsilon \rangle_{\mathrm{McM} \to \mathrm{SCH}}$ in [°F]
1985	6.83	2003	5.29
1986	3.36	2004	5.29
1988	**8.16**	2005	8.17
1989	5.47	2006	6.75
1994	6.56	2007	6.99
1997	7.79	2008	6.71
1998	6.93	2009	7.26
1999	7.43	2010	6.65
2000	7.93	2011	7.18
2001	5.02	2012	6.88
2002	5.03	Average (N = 21)	6.51°F

* For years not listed in the Tab. 7.1, the minimum daily temperatures data were corrupted for both, or either McMurdo or Schwerdtfeger weather stations. For example the data is incomplete for the following dates: 1986 (Mar. 14th, 15th and 17th–19th), 1987 (Mar. 12th–19th), 1996 (Mar. 16th–19th), 2000 (Mar. 19th). Additionally for the years 1990–1993 and 1995 no analysis was made, due to data corruption for the entire period of Feb. 27th through to Mar. 19th. In spite of the fact that for the year 1988 the data for Mar. 12th–19th is missing, I listed the absolute retrodiction error in the above table for the sake of illustrating the coldest year.

daily minimum temperatures at Schwerdtfeger station. The procedure was repeated day after day for a given year, and absolute prediction error ε for the above formula was calculated for N = 1. The prediction errors obtained from this are collected in Tab. 7.1.

On Fig. 7.4, I depicted changes of minimum temperatures absolute errors $\langle\varepsilon\rangle$ as summarized in Tab. 7.1. The absence of respective absolute errors $\langle\varepsilon\rangle$ for years 1990–1993 and 1995 resulted from temperature data corruption either/ or at McMurdo and Schwerdtfeger weather stations. On the same figure, I also depicted the average absolute error calculated over all available years. Its value is $\langle\varepsilon\rangle_{\mathrm{McM}\rightarrow\mathrm{SCH}} = \pm 6.5°\mathrm{F}$ ($\approx \pm 3.6°\mathrm{C}$). This value of $\pm 6.5°\mathrm{F}$ must be understood as an *interval* rather than specific temperature.

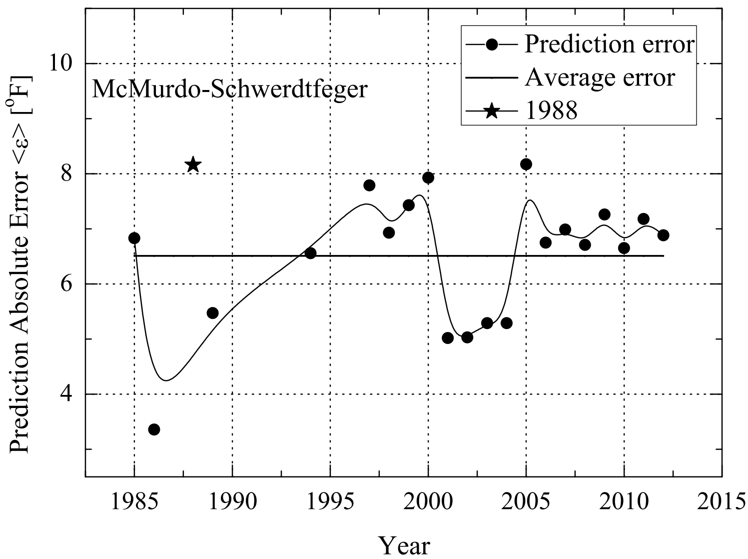


Figure 7.4. Absolute retrodiction error $\langle\varepsilon\rangle$ in °F denoted by • for all the years available for a continuous string of daily minimum temperatures for the pair of Schwerdtfeger and McMurdo station's records. The solid line is the B-spline fit. For the years not depicted on this figure, the temperature data for the period of Feb. 27th through Mar. 19th were corrupted at either station. The average retrodiction error $\langle\varepsilon\rangle = \pm 6.5°\mathrm{F}$ ($\approx \pm 3.6°\mathrm{C}$) is indicated by a continuous black line. Absolute retrodiction error for the coldest year on the record, 1988 is indicated by ★. One should observe that in the case of 1988, a pair (Schwerdtfeger-McMurdo) of daily minimum temperature data measurements is available only from Feb. 27th through Mar. 11th.

A careful and investigative reader may notice that the absolute retrodiction error $\langle\varepsilon\rangle_{\mathrm{McM}\rightarrow\mathrm{SCH}} = \pm 6.5°\mathrm{F}$ reported above is slightly lower than the same absolute error previously reported by me two years ago in research publications.[18] The error found and communicated there was $\langle\varepsilon\rangle = \pm 7.1°\mathrm{F}$. Not a big difference, but nevertheless $\pm$ 0.6°F. The difference resulted from me overlooking the different time zones used in reporting meteorological data at McMurdo and Schwerdtfeger weather stations. Both stations are located at the Ross Dependency along a similar meridian of 166.667 and 169.97, respectively. Therefore I assumed, not even thinking about it, that me-

teorological data from these stations must be reported in the same time zone, that is in NZST (New Zealand Standard Time).[19] However, this is not the case and meteorological data at Schwerdtfeger weather station is reported in UTC (Coordinated Universal Time) and UTC = NZST + 12h.

Thus, the developed ANN was capable, on the basis of McMurdo daily minimum temperatures, to retrodict respective daily minimum temperatures at the Schwerdtfeger weather station location with an average absolute error of $\langle\varepsilon\rangle_{\mathrm{McM}\rightarrow\mathrm{SCH}} = \pm 6.5°\mathrm{F}$ ($\approx \pm 3.6°\mathrm{C}$). From Tab. 7.1 and respectively Fig. 7.4, one can see that on a few occasions the absolute error was above and below its averaged value. On a few occasions, it stayed just around its averaged value.

Despite the fact that the only available pairs of daily minimum temperatures from 1988 for the Schwerdtfeger-McMurdo stations are short and run only from Feb. 27th through Mar. 11th, the respective ANN retrodiction of daily minimum temperatures was performed. The results are depicted on Fig. 7.5 for an extra extended period of time to compensate, from Feb. 19th through Mar. 11th, 1988.

The described procedure above was also performed for the McMurdo and Elaine stations, with the results summarized in Tab. 7.2.

Table 7.2. A summary* of ANN prediction of daily minimum temperatures absolute retrodiction errors $\langle\varepsilon\rangle$ obtained for the listed years, for Feb. 27th through to Mar. 19th at Elaine station, $\mathrm{McM} \xrightarrow{\text{Retrodiction}} \mathrm{EL}$. The average absolute error was calculated for N = 14.

Year	Absolute Retrodiction error ⟨ε⟩ in[°F]	Year	Absolute Retrodiction error ⟨ε⟩ in [°F]
1986	7.50	1998	5.72
1987	8.61	2000	9.86
1988	**8.69**	2001	12.03
1993	8.48	2002	11.97
1994	4.01	2003	10.63
1995	9.12	2010	4.14
1996	8.13	Average (N = 14)	8.18°F
1997	7.15		

* For years not listed in the Tab. 7.2, the minimum daily temperatures data was corrupted for both or either McMurdo and Elaine weather stations, or was due to Elaine being turned off (see subsection 4.1.1).

Thus, in the case of minimum daily temperatures retrodiction for the pair McMurdo and Elaine weather stations, the average absolute error is $\langle\varepsilon\rangle_{\mathrm{McM}\rightarrow\mathrm{EL}} = \pm 8.2°\mathrm{F}\left(\approx \pm 4.6°\mathrm{C}\right)$.

Now it is time to turn to an analysis of historical temperature data measured at near proximity to Captain Scott's location of One Ton Depôt. Historical near surface minimum (or the *lowest*) daily temperatures were reported by

- Main Polar Party (Nov. 14th through 22nd, 1911)[20],
- Motor Party (Nov. 8th through 13th and Dec. 1st through 9th, 1911)[21],

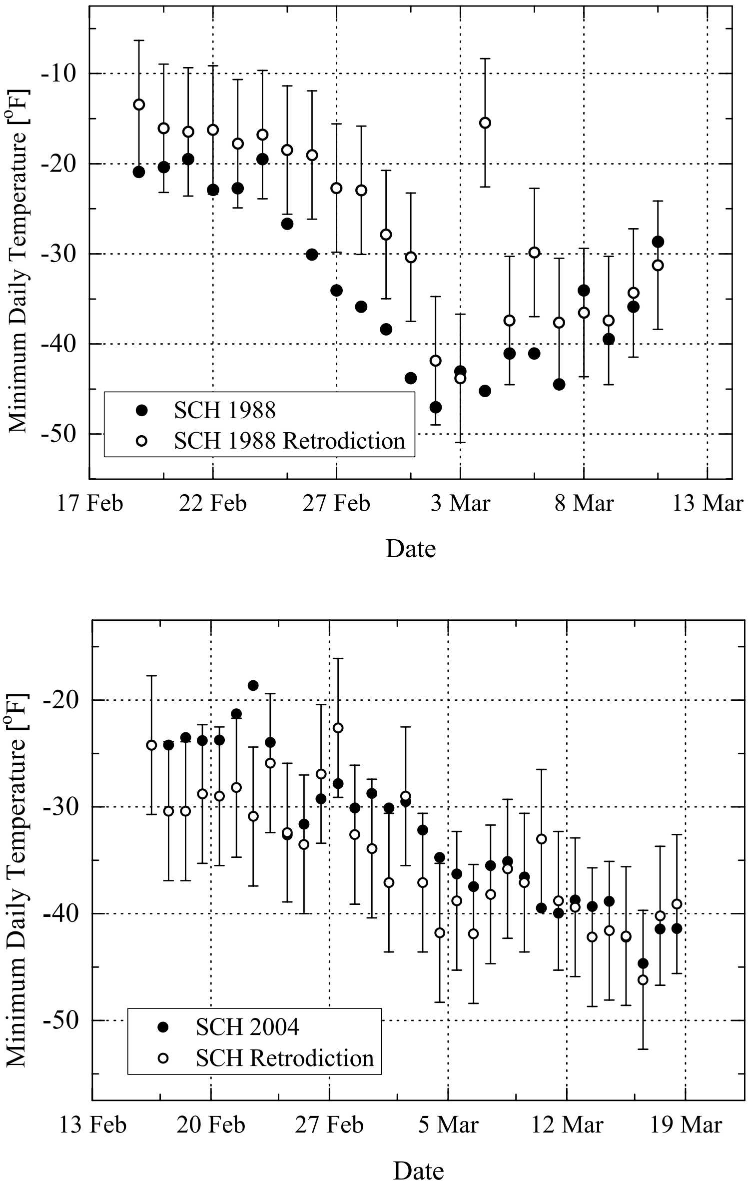


Figure 7.5. Daily minimum temperatures recorded at Schwerdtfeger station (●) in 1988 and 2004, and their retrodicted by ANN values (○) for the same location and period of time. See main text for discussion of these figures.

- Day's Depot Party (Jan. 7^{th} through 11^{th}, 1912)[22],
- First Return Party (Jan. 17^{th} through 18^{th}, 1912)[23],
- Second Return Party (Feb. 4^{th} through 9^{th}, 1912)[24],
- Lt Shackleton's Party (Nov. 11^{th} through 17^{th}, 1908 and Feb. 11^{th} through 19^{th}, 1909).[25]

Minimum daily temperatures were retrodicted from historical minimum temperature data recorded at Cape Evans and Cape Royds, respectively. The results are depicted on Fig. 7.6. It is evident from these simulations that my neural network is capable of precise retrodiction of all minimum temperatures reported by various parties at different times of the year. None of the measured and retrodicted minimum temperatures are biased. As one would expect, they randomly fluctuate around one another. From the above, I have established and verified essential pieces of evidence, with which I can retrodict with fair accuracy the respective temperatures at the environs of One Ton Depôt, based on minimum temperature measurements at McMurdo (1985–2012), Cape Evans (1911–1912), or Cape Royds (1908–1909).

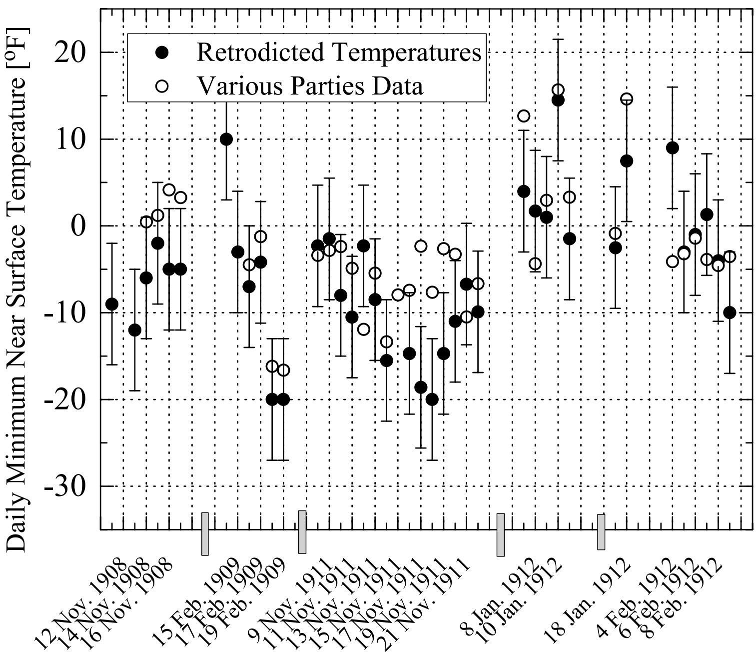


Figure 7.6. Historical minimum (or the lowest) and retrodicted daily temperatures at the environs of One Ton Depôt. The historical data is denoted by • and data retrodicted by ANN are denoted by ○, respectively. The following temperature data is depicted: Lt Shackleton's Party (Nov. 11th through 17th, 1908 & Feb.11th through 19th, 1909), Motor Party (Nov. 8th through 13th & Dec. 1st through 9th, 1911), Main Polar Party (Nov. 14th through 22nd, 1911), Day's Depôt Party (Jan. 7th through 11th, 1912), First Return Party (Jan. 17th through 18th, 1912), and Second Return Party (Feb. 4th through 9th, 1912). The data of the First Relief Party (Cherry-Garrard and Dmitrii) are depicted on the next figure.

There is one more piece of meteorological evidence which one must examine before looking at Captain Scott's temperature record. In section 2.3, I critically examined Cherry-Garrard's role in Captain Scott's expedition, and in particular his ill-conceived relief effort on late February and early March 1912. Now I will investigate his Relief Party record. Unfortunately, Apsley Cherry-Garrard did not carry the minimum temperature thermometer. For that reason, he did not report its readings.

Instead, during his journey and stay at One Ton Depôt, he recorded three temperature readings, usually in the morning, afternoon and in the evening. In view of my discussion of Cherry-Garrard's supposed inability to learn and use a compass, it is surprising that he was able to read and reset the thermometer.

Let me recall a few details which I analyzed in greater "resolution" in section 2.3. On Feb. 26^{th}, 1912 at 8:30 a.m., Cherry-Garrard, and Dmitrii left Hut Point on a plainly belated relief journey towards One Ton Depôt. By dog sledging, they arrived at the depôt in the evening of Mar. 3^{rd}, 1912, and stayed there until 1:45 pm. Mar. 10^{th}, before journeying back to Hut Point, where they arrived on Mar. 15^{th}.[26]

It appears that the meteorological record of Cherry-Garrard would be the most useful in re-analysis of Captain Scott's record, as for a good time both parties were separated by between 110 miles (Mar. 3^{rd}) and 62 miles (Mar. 10^{th}). However, because Cherry-Garrard *did not* use the minimum temperature thermometer, our insight is a bit limited.

On Fig. 7.7, I depicted Cherry-Garrard's entire temperature record during his alleged relief journey.[27] I also depicted there the least squares fit of the second-degree polynomial $\left(f\left(x\right) \propto x^2\right)$ to the Cherry-Garrard data. It is a simplified presentation, but it is useful. After Cherry-Garrard's departure from Hut Point, his potential temperature record was influenced (driven) by a convolution of temperature decreasing due to his leaving Hut Point, and due to winter approaching. Without attempting to de-convolute these two processes, one can observe from Fig. 7.7 that the temperature experienced by Cherry-Garrard was systematically (every traveled day) decreasing, despite continuous and inherent fluctuations.

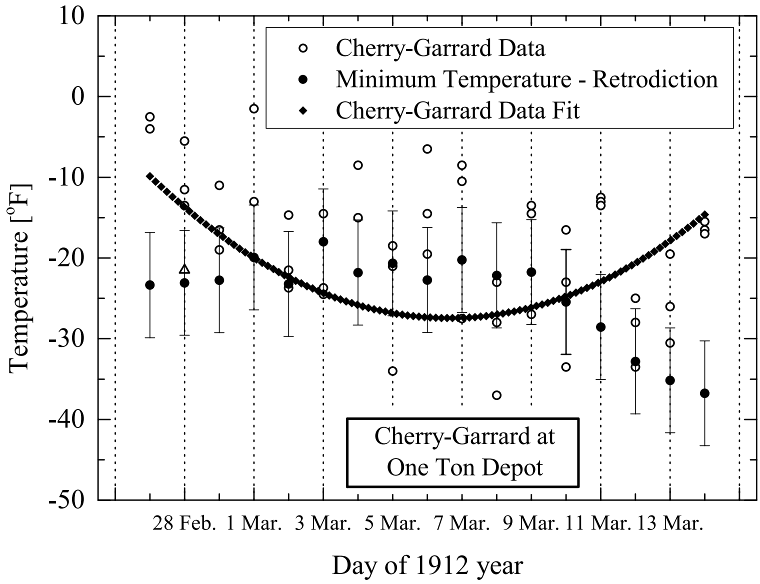


Figure 7.7. Comparison of all temperatures recorded by Cherry-Garrard's First Relief Party (•), with the minimum daily temperatures (•) retrodicted by my artificial neural network at One Ton Depôt location. The line (squares ▪) represent the least squares fit of the second-degree polynomial $\left(f\left(x\right) \propto x^2\right)$ to Cherry-Garrard's data.

The party, after arriving at One Ton Depôt, stayed there until Mar. 10th and then hastily rushed back to Hut Point. During that time, as I indicated on the figure, the temperature at One Ton Depôt was gradually decreasing until the party dog-sledged back to Hut Point.

The general behavior of the temperatures recorded by the First Relief Party is as one would expect. Even though inherent temperature fluctuations were observed, no abrupt decrease or other unusual and systematic changes were recorded.

Ever since I studied Dr Simpson's account of Captain Scott's temperature record, I was wondering why he was not seriously concerned with the notion that the *Extreme Cold Snap* recorded by Captain Scott was not observed, not only at the Hut Point/ Cape Evans, but also – and with increasing astonishment – at One Ton Depôt by Cherry-Garrard from Mar. 3rd through to Mar. 10th, 1912.

This observation gives an additional argument that Dr Simpson's unsupported assumption, that the temperature gradient at the given time instance can be divided into two regions south and north of One Ton Depôt, is absolutely wrong. Indeed, it was Dr Simpson's counterfactual invention to account for the *Extreme Cold Snap*.

On the same figure, Fig. 7.7, I additionally depicted the results of my artificial neural network temperature retrodiction of minimum daily temperatures at the One Ton Depôt location during Cherry-Garrard's journey period. The retrodicted temperatures nicely coincide with Cherry-Garrard's record, represented by the polynomial line fit and its behavior.

In summary, one can observe that a developed and trained artificial neural network using temperature data (McMurdo, Cape Evans and Cape Royds) was capable of retrodicting the respective temperatures at the One Ton Depôt location with fair accuracy. Above, I confirmed that every party's temperature record reported at the region of One Ton Depôt was accurate and trustworthy.

7.4. The Extreme Cold Snap

7.4.1. Captain Scott Temperature Record Retrodiction

By now, I am fully equipped to analyze the main objective of this chapter, and indeed the whole book. This objective is to verify the *Extreme Cold Snap* Hypothesis. The measured and reported minimum/lowest temperatures by Captain Scott's party, together with retrodicted values in the vicinity of the Schwerdtfeger and Elaine weather stations, from the historical data of minimum temperatures measured at Cape Evans. They are clearly depicted in Fig. 7.8.

From Fig. 7.8, it is self-evident that from Feb. 27th, 1912 until the end of Captain Scott's record, on Mar. 27th, 1912, for thirty consecutive days (with a few exceptions, see discussion below) the reported and retrodicted minimum daily temperatures significantly diverge. This divergence is significant as far as its persistence in time and variation is considered.

The discrepancy between the temperatures reported by Captain Scott and the retrodicted minimum/lowest daily temperatures is significant, in the sense that the majority of Captain Scott's temperature data lies *well below* the retrodicted temperatures and their retrodiction absolute errors. The retrodicted minimum/lowest temperatures are much higher than these reported by Captain Scott.

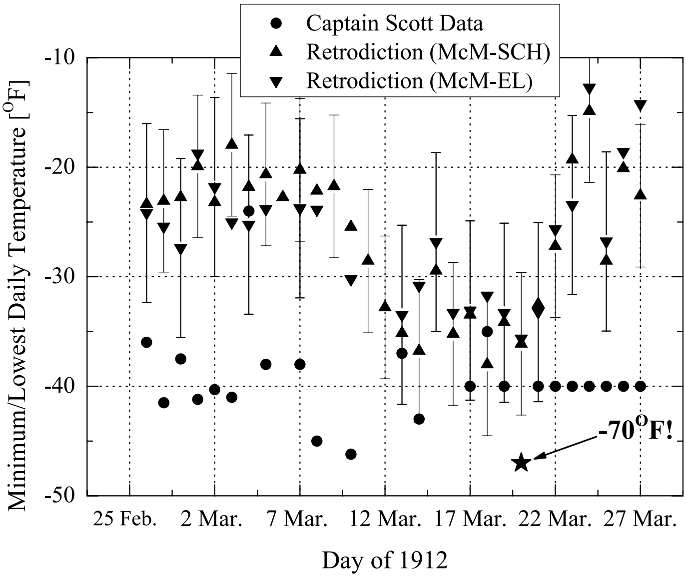


Figure 7.8. Historical near surface minimum daily temperatures (or the *lowest*) reported by Lt Bowers and Captain Scott (•, ★), together with the respective minimum temperatures (▲(McM→SCH) and ▼(McM→EL)) retrodicted from historical minimum temperatures recorded at Cape Evans in 1912. Temperature readings after Mar. 10th are not minimum near surface temperatures. See main text for more discussion. Additionally, for the following days reported by Captain Scott, the temperatures are the lowest reported up until that day: Feb. 15th through Feb. 25th without Feb. 16th, 17th, and 20th, Mar. 3rd and 7th, Mar. 21st through to 27th. For Feb. 26th, retrodicted and reported temperatures are almost the same, since only Captain Scott's data for this day is depicted. The *Super Extreme Cold Snap* temperature of –70°F indicated by ★ cannot be placed (drawn) within this figure scale.

In the case of the Schwerdtfeger (One Ton Depôt) and Elaine station locations, retrodicted temperatures *on average* are higher than these reported by Captain Scott by 17.6°F and 21.4°F, respectively, for Feb. 27th through Mar. 27th, 1912.

Such a divergence between retrodicted and historical temperatures reported by Captain Scott can be attributed to:

1. the inaccuracy of retrodiction method,
2. incorrect temperature data readings due to Captain Scott's party thermometer malfunctioning,
3. long-term temperature changes in the Antarctic,
4. location differences,
5. *El Niño* teleconnection with One Ton Depôt,
6. the temperature data documented by Lt Bowers and Captain Scott were distorted to exaggerate real weather conditions.

Let me now investigate in more detail the above possible sources of observed discrepancy between Captain Scott's temperatures and the *retrodicted* daily minimum temperatures.

7.4.2. Inaccuracy of Retrodiction Method

The very essence of my work was to find a scientific method which at least in principle could be used to investigate Captain Scott's meteorological record. An additional and fundamental requirement of the method was its ability to draw results from the very few *historical* meteorological data measurements available for analysis. At the beginning, it seemed that an artificial neural network with its predictive (retrodictive) powers may be the right approach. An alternative method based on the so-called genetic algorithms (GA) also appealed to me. Due to computer coding problems with GA, I abandoned its usage for the current problem. However, it may happen one day that someone, using GA or another method(s), will gain additional insight into the historical data of Captain Scott.

The whole issue of teaching and then using an artificial neural network is related to network performance measured by its absolute error. Artificial neural network performance is thus not only related to its architecture, but also to the behavior of the time series, of which the network must learn and then predict.

Through the great number of numerical simulation of different architectures, transfer functions, and methods of learning, I found that the artificial neural network depicted on Scheme 7.1 gave the best results. By saying "the best results," I mean that the absolute error for a *given* network and *given* time series (minimum daily temperatures) was the smallest one.

After working on all of these details, I arrived at the result that the average retrodiction absolute error for $\mathrm{McM} \xrightarrow{\text{Retrodiction}} \mathrm{SCH}$ was $\langle \varepsilon \rangle_{\text{average}} = \pm 6.5\,°\mathrm{F}$. It means that all of the 440 retrodicted modern minimum temperature data[28] measurements at the Schwerdtfeger weather station were on average in the range of $\langle \varepsilon \rangle_{\text{average}}$. Indeed, year to year, the actual value of retrodiction absolute error was changing, as shown in Table 7.1 and depicted on Fig. 7.4, in a certain *limited* range. Moreover, observed deviations of retrodicted minimum temperatures are random fluctuations around actual temperatures, which are highly variable. The worst (biggest) deviation from the average retrodiction absolute error was observed, as shown in Table 7.1 and Fig. 7.4, during the year 2005, and it was $\langle \varepsilon \rangle_{2005} = \pm 8.17\,°\mathrm{F}$. Thus, in the worst case scenario, for all available temperature data, the absolute retrodiction error deviated from its mean by ±1.67°F. However, a comparison of ±1.67°F deviation with the one calculated for Lt Bowers and Captain Scott's data, 17.6°F, is telling.

A similar reasoning is also applicable to the $\mathrm{McM} \xrightarrow{\text{Retrodiction}} \mathrm{EL}$ case, pending different numerical results including final deviation from the Captain Scott's data, which is about 21.4°F.

One should also not overlook the variability of daily minimum temperatures at the Schwerdtfeger/Elaine stations. In order to illustrate the variability of minimum near surface temperatures, and the capacity of the artificial neural network which is used in this work, to learn and retrodict widely and freely fluctuating temperatures, I have presented the fluctuations of minimum near surface temperatures at the

Schwerdtfeger station for all years available on Fig. 7.9. The cloud of minimum daily temperatures is impressive and shows large fluctuations.

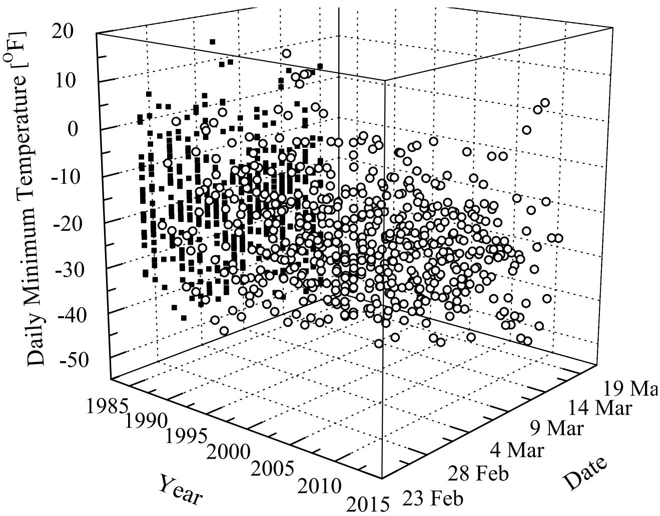


Figure 7.9. Three-dimensional plot of the minimum daily near surface air temperatures recorded at Schwerdtfeger weather station during the 1985–2012 period. The actual daily minimum temperatures are depicted by ○. YZ projection of these temperatures is indicated by ■.

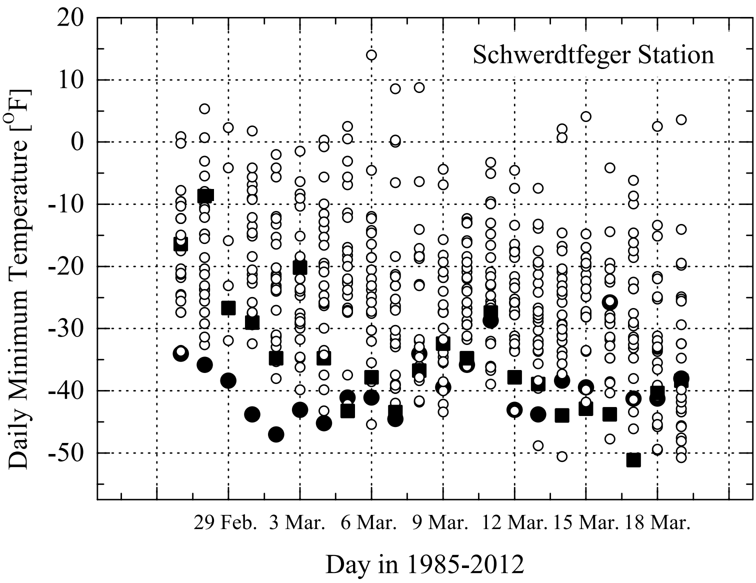


Figure 7.10. The minimum daily near surface air temperatures recorded at Schwerdtfeger weather station during the 1985–2012 period. Using • and ■ I denoted daily minimum temperature changes in the coldest year (1988) and second coldest year (2004) on the record. For reasons of transparency, I did not differentiate temperature entries for the remaining years.

On the following figure, Fig. 7.10, I depicted a two-dimensional projection of daily minimum temperatures. I also depicted their respective changes of temperature for the coldest (1988) and second coldest (2004) years on the record.

From this figure, one can readily notice that minimum near surface temperatures fluctuate in a very wide range of all possible values, from $\langle +14, -51.2\rangle$°F = $\langle \text{Mar. } 6^{\text{th}}, 1992,\ \text{Mar. } 17^{\text{th}}, 2004\rangle$ °F. Taking into account the fact that the near surface air minimum temperatures at the Schwerdtfeger weather station fluctuated between $\langle +14, -51.2\rangle$ °F, this indicates a fairly acceptable precision: about $\langle \varepsilon \rangle = \pm 6.5$ °F for the retrodiction power of my neural network.

In addition to the above, one must also observe that my artificial neural network was successfully used, as depicted on Fig. 7.6, to retrodict a good number of temperature records measured by several parties at One Ton Depôt and in its vicinity.

Finally, as depicted on Fig. 7.7, I was able to retrodict temperatures and a general trend of temperature change during Cherry-Garrard's journey and his bivouac at One Ton Depôt in early March 1912.

Thus, I am certain and convinced that the artificial neural network developed and used in my work is capable of accurately retrodicting modern and historical near surface daily minimum temperatures.

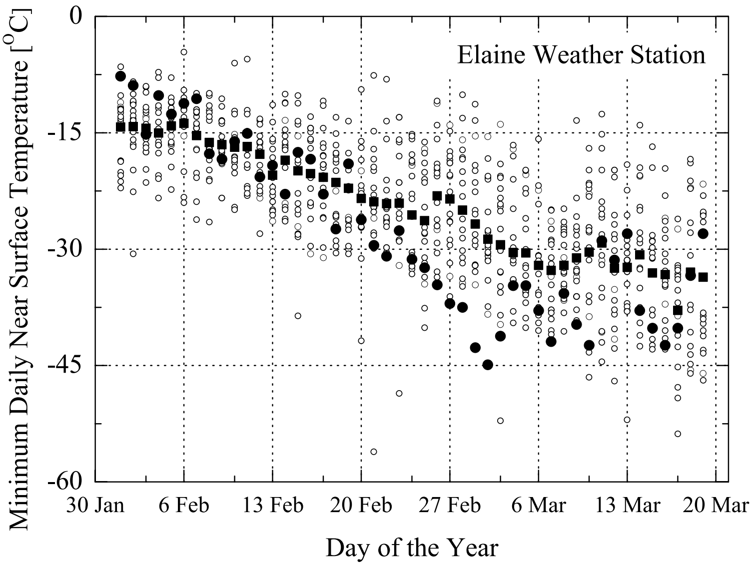


Figure 7.11. The minimum daily near surface air temperatures recorded at Elaine weather station during the 1985–2012 period (the years not listed in Table 7.2 are not depicted on this figure). Using • I denoted daily minimum temperature changes in the coldest year (1988). An average minimum daily near surface temperature is denoted by ▪. For reasons of transparency, I did not differentiate temperatures entries for the remaining years. To make this figure, I used so-called "10-minute untreated data". The numbers observed in the lower part of the figure are recording instrument or satellite transmission glitches.

7.4.3. Location Differences

This concern is related to obvious differences in geographical locations where modern and historical temperature measurements were taken. However, different geographical locations do not automatically imply different temperatures, and the basic meteorological concept of an isotherm – a contour line that connects points of equal temperature at a given date or time on a geographic map – should be not forgotten. Nothing strange is in that say London (UK) {51.507222, –0.1275} and Podkowa Leśna (central Poland) {52.11897215, 20.73424801}, and/or Gliczarów Górny (southern Poland) {49.34300903, 20.0673087} where I live, have the same temperature and are "connected" by an isotherm at a certain time.

A citation must be added here, that from the same temperature at different locations at a certain time, the notion that these places are somehow "isothermally connected" does not automatically follow.

In the case of the Ross Ice Shelf, a number of figures illustrating isotherms were made as early as Dr Simpson's summary volume. The reader may also consult the rarely "read" second volume of the same author with the telling title: *Vol. II, Weather Maps and Pressure Curves*, where a great number of isotherms were presented.[29]

On a number of occasions throughout this book, I referred to the physically fundamental *concept of continuum*, which in the case of atmospheric air means that its physical properties are continuously distributed, at least in the so-called boundary layer. Much effort in physics has been devoted to understanding the concept of a continuum. The concept of a continuum of a given system hinges on the existence of its ergodicity. Recalling my analysis of wind events (Chapter 1.4), the reader may also recall my proof that the winds over the Ross Ice Shelf and over the Antarctic continent form an ergodic system. Thus, the continuity of the boundary air layer over the Antarctic continent was demonstrated.

7.4.3.1. Schwerdtfeger *vs.* Elaine Temperature Gradient

Due to general trends in Earth's climate, going south or north from a given location implies a temperature gradient. Indeed Fig. 7.1, where I depicted average temperatures at the South Pole, Schwerdtfeger, and Scott Base, clearly confirm this general temperature notion. However, let us look more closely at temperature gradients at the Ross Ice Shelf along Captain Scott's route from the South Pole.

Further south from Schwerdtfeger station, and along Captain Scott's original route, the lonely weather station named Elaine {–83.134, 174.169} has stood since 1986. On Feb. 27th, 1912, the Captain Scott party was about 112 km (70 miles) from the future Elaine weather station's location, which was twice as close than the Schwerdtfeger (One Ton Depôt) station.

Let us first look at general temperature behavior at the location of the Elaine weather station. The surprising behavior of temperature changes at Elaine station, as compared with respective changes at Schwerdtfeger station, is depicted on Fig. 7.2.

Although the averaged minimum temperatures presented in Fig. 7.2 can be exceptionally well approximated by linear regression analysis, its very nature is nonlinear. One has to notice that I have presented only temperatures for the first quarter of the year. The actual yearly averaged minimum temperature, as depicted on Fig. 7.1,

has a U-shaped letter with a distinctive coreless winter, April through September, and a short-lived crest temperature between the beginning and end of summer, December through January.

Fig. 7.2 also shows that although the Elaine station is further South than the Schwerdtfeger station, the daily minimum temperature at the Elaine is frequently close to or above that of the Schwerdtfeger station. I attribute this phenomenon to an adiabatic effect of air warming by katabatic winds flowing downwards from the Beardmore Glacier.

Provided that the calculation of the average minimum temperature is meaningful or at least shows its general behavior, one can find that during the period of Feb. 27th through Mar. 19th the average difference between Elaine and Schwerdtfeger is +2.6°F. It means that during the considered period of time, the near surface air temperature is generally a bit higher at Elaine weather station than at Schwerdtfeger station.

Since there are no other weather stations between these two, one, using the above-mentioned principle of continuity, can reason that while moving toward Schwerdtfeger station (One Ton Depôt), the convolution of a negative temperature gradient due to both gradual northward movement and simultaneous winter advancement should be present and recorded.

From this perspective, as well as assuming the contrary, the positive temperature gradient over the Polar Party's route on the Barrier, one must wonder what exactly was meant when Captain Scott addressed in his *Message to the Public*[30]

> But all the facts above enumerated were as nothing to the surprise which awaited us on the Barrier. I maintain that our arrangements for returning were quite adequate, and that no one in the world would have expected the temperatures and surfaces which we encountered at this time of the year. On the summit in lat. 85° 86° we had – 20°, – 30°. On the Barrier in lat. 82°, 10,000 feet lower, we had –30° in the day, –47° [*sic*] at night pretty regularly, with continuous head wind during our day marches. It is clear that these circumstances come on very suddenly, and our wreck is certainly due to this sudden advent of severe weather …

From the above, it is evident that Captain Scott appeals to the reader's common sense knowledge, well established before the *Terra Nova Expedition*, that "a fall of temperature of 1°F for every 300 feet occurs, so that a tableland on the summit of a mountain 3,000 feet high will have a mean temperature 10°F."[31] Thus, Captain Scott insinuates in his *Message to the Public* that the laws of physics were suspended and an expected increase of air temperature due to the lapse rate of 1°F/300ft did not occur. Since the party descended about 10,000 ft, Captain Scott fallaciously expected a temperature increase of roughly 10,000/300 ≈ 33°F, that is about 0°F. Thus instead of "–30° in the day, and –47° [*sic*] at night pretty regularly," he expected about 0°F.

However, Captain Scott was wrong in his fallacious account that in the concept of lapse rate, an implicit assumption of simultaneous temperature measurement at different heights is present. The Polar Party spent about 10 long days descending the Beardmore Glacier from Feb. 7th through to the 17th, and did not fall in a split second from 10,000 ft to almost sea level. Thus, Captain Scott's summit record of –20, –30°F is not a *suitable reference* point to calculate the actual temperature at the Barrier due to

a decrease in height. The winter was advancing, not only at Captain Scott's location on the Barrier, but also on the Antarctic Plateau.

Thus, if Captain Scott's description of the temperatures after descending the Beardmore Glacier was fair, he should consider the relationship between the three temperature gradients:

- Negative temperature gradient at the Antarctic Plateau,
- Lapse rate,
- Negative temperature gradient at the Barrier,

and the variability (fluctuations) of these gradients.

One would say that at that time, such analysis was impossible to a weary Captain Scott. If so, he should not made such a comment. However, if the contrary is true, it should be a sound argument. Captain Scott, by using his own data as well as the temperature data of Lt Shackleton, could make an educated guess that both negative temperature gradients at the Antarctic Plateau and the Barrier are about 5°F per week until the coreless winter sets in. The range of temperature fluctuations could be also roughly estimated to be at least ±15°F.

Thus, if Captain Scott recorded –30°F on the Antarctic Plateau, then after two weeks of descending *via* the Beardmore Glacier, one gets a temperature of –40°F at the Plateau. This temperature transforms into about –10°F at the Barrier. However, since the negative temperature gradient was also present at the Barrier, one could expect an additional –10°F. Finally, Captain Scott could arrive at a theoretical temperature at the foot of the Beardmore Glacier to be about –20°F. Comparing (–20°F) with his actual reported temperature of –30°F is not particularly surprising given a temperature fluctuation range ±15°F, he could expect temperatures in the range (–20±15)°F.

Thus, Captain Scott's lamenting of low temperatures after reaching the Barrier is not justified, even using the above elementary predictions fully available to him. One of even several singular low temperatures would be expected for temperature fluctuations. However, Captain Scott informs us that he recorded "–47° [*sic*] at night pretty regularly". Since Captain Scott never before quoted the figure of –47°, it appears it was Captain Scott's invention, in his *Message to the Public*, to exaggerate the weather conditions encountered by the party.

All retrodictions described in subsection 7.4.1 and depicted on Fig. 7.8 were made for the physical locations of Schwerdtfeger weather station {–79.875, 170.105} and Elaine {–83.094, 174.285}.[32] On Feb. 27th, 1912, the Captain Scott party was at about {–82.2822, 170}. It is roughly 269 km (145 miles) and 112 km (61 miles) from Schwerdtfeger and Elaine, respectively. However, Captain Scott camp was in the neighborhood of the modern Schwerdtfeger weather station's location, and far away from the Elaine station's location. From Fig. 7.8, one can see that no particular bias in retrodiction of temperatures is present, as though both the Schwerdtfeger and Elaine stations' temperature records were equivalent.

Indeed, Fig. 7.2 which illustrates average daily minimum temperatures at these weather stations shows a peculiar relationship between the respective temperature gradients. On average and for most of the dates depicted on this figure, the daily minimum temperature at the Elaine station is higher than the respective temperature at the Schwerdtfeger station. More importantly, during the time of the year which

interests us the most, the average difference between these two stations is ~2.6°F for the Elaine station.

The temperature retrodictions for pairs $\mathrm{McM} \xrightarrow{\text{Retrodiction}} \mathrm{SCH}$ and $\mathrm{McM} \xrightarrow{\text{Retrodiction}} \mathrm{EL}$ depicted on Fig. 7.8 are rather randomly distributed, without bias to either the first or second pair. Thus, one can conclude that when comparing Captain Scott's data to either stations' retrodictions, it does not significantly influence the observed difference between retrodictions and Captain Scott's data.

This conclusion is also supported by the underlying assumption of continuity, and by the fact that the difference $\left(\Delta\langle\varepsilon\rangle\right)$ between absolute retrodiction errors, $\Delta\langle\varepsilon\rangle = \langle\varepsilon\rangle_{\mathrm{Elaine}} - \langle\varepsilon\rangle_{\mathrm{Schwerdtfeger}} = 1.67°\mathrm{F}$, is indeed small and in no way can account for the overall difference between the retrodicted data and Captain Scott's temperature data, provided that current temperature records are close to the climatological one.

In addition to the above, the McMurdo {–77.85, 166.666667} weather station, whose data has been used in my work, is not situated at the same location as the Cape Evans {–77.633333, 166.4} weather station. Thus, the distance in a straight line is about 25 km (13.5 miles).

7.4.3.2. McMurdo *vs.* Cape Evans Temperature Gradient

From the above analysis of the Schwerdtfeger *vs.* Elaine weather station location temperature gradients, I concluded that even though certain differences are indeed observed, they in no way could account for the differences between the minimum/lowest temperatures reported by Captain Scott, and the minimum temperatures retrodicted by my artificial neural network.

The knowledgeable reader would also wonder about the fact that the location of the historical weather station at Cape Evans does not match the modern McMurdo weather station, whose data was used to train the neural network. Thus, a possible error may arise due to a different set of temperatures used in training and retrodiction runs of the neural network.

Just by looking at the extent of the edge of the Ross Ice Shelf at the McMurdo Sound, one can formulate a general, climatological notion that the temperatures recorded at McMurdo station should be lower (negative gradient) than those simultaneously recorded at Cape Evans.

Indeed, during Captain Scott's *Terra Nova Expedition*, his former *Discovery Expedition* quarters at Hut Point served as a transition shelter for the various parties traveling between the Barrier and Cape Evans. If time and duties permitted, meteorological measurements were taken.

By using this data, and comparing with the respective data recorded at Cape Evans, one can get a plot as depicted on Fig. 7.12. By examining this figure, one readily notices that during the available historical record, the minimum daily temperature was a few degrees lower at Hut Point compared with the Cape Evans data. Since the data depicted on Fig. 7.12 represents a very short period of time, it is not certain that the observed negative temperature gradient toward Hut Point location is a permanent feature rather than a temporary fluctuation. In view of data shortage, one can confirm the temperature gradient and one could again look at the natural and ice formation features of McMurdo Sound. Indeed, the semi-permanent Barrier edge

abruptly stops just before reaching the Hut Point Peninsula. This feature, combined with minimum temperature behavior depicted on Fig. 7.12, implies that a certain negative temperature gradient exists between Cape Evans and Hut Point, and thus the McMurdo weather station location.

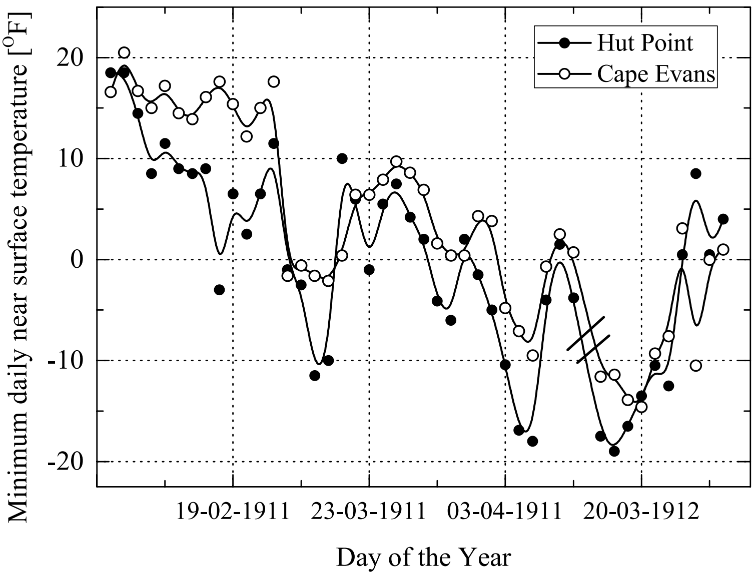


Figure 7.12. Minimum daily temperatures recorded simultaneously at Cape Evans and Hut Point in 1911–12. For illustrative purposes, the temperature points are connected by a B(basic)-spline function. Note that the abscissa (horizontal coordinate) is not continuous; it ends on Apr. 10th, 1911, resumes on Mar. 17th, 1912, and continues from Mar. 17th through Mar. 27th, 1912.

Due to the obvious shortage of temperature data, I am not able to do a precise evaluation of the observed negative gradient on artificial neural network training and subsequent data retrodiction. However, since the presence of the negative temperature gradient between Cape Evans and Hut Point (*i.e.* McMurdo) was deduced, I can use my artificial neural network to simulate an inferred temperature difference.

My neural network is ideally suited to answer any question as to how an eventual temperature difference would affect the overall prediction and retrodiction procedures related to the discussed case.

Provided that the calculation of the average temperature difference for the historical data depicted on Fig. 7.12 is representative, one can obtain the difference of 2.45°F for Hut Point (McMurdo). In order to be on the safe side, one can add an extra margin for temperature difference – say half of this value – and obtain a difference of about 3.6°F. Additionally, because temperature fluctuations may occur, it is safe to assume that the expected temperature difference between these two sites will vary between ±3.6°F (±2°C).

The whole procedure of neural network training and retrodiction was again performed, but this time with the plus/minus perturbed minimum daily tempera-

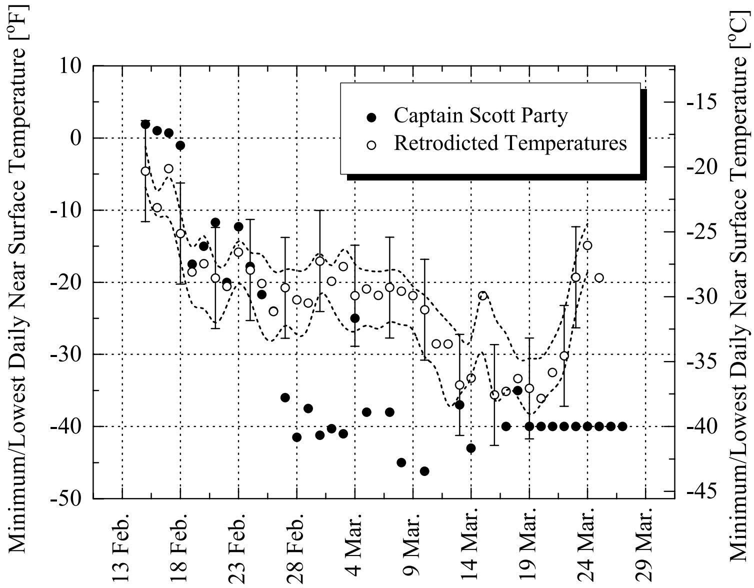


Figure 7.13. Historical near surface minimum daily temperatures (or the *lowest*) reported by Lt Bowers and Captain Scott, together with the respective minimum temperatures retrodicted from historical minimum temperatures recorded at Cape Evans in 1912. The upper and lower dashed lines are obtained after the McMurdo minimum temperature data was perturbed by ±3.6°F (±2°C). The data after March 19th represents Captain Scott's statement to Sir Francis: "Excuse writing – it is –40°, and has been for nigh a month."

tures. Thus, the whole set of data was obtained and an additional neural network retrodiction run on this historical data was performed. The results are depicted on Fig. 7.13.

The upper dashed curve was obtained after the McMurdo data was perturbed by +3.6°F and the lower dashed curve by –3.6°F, respectively. This numerical experiment shows that even if there was a slight temperature dependence due to intricate meteorological and/or physical features at Ross Island and McMurdo Sound, it was negligible and insignificant in accounting for the differences as depicted on Fig. 7.8 between Captain Scott's and the retrodicted temperature data. Simultaneously, this numerical experiment further confirms that the artificial neural network used in this work is sensitive and capable of responding to fine temperature changes in training and analysis of data.

Moreover, since it is sound to assume that temperature data recorded at McMurdo (Hut Point) is slightly colder than the respective data at Cape Evans, one must inevitably observe that by using "colder" data in retrodiction of Captain Scott's data as depicted on Fig. 7.8, my retrodicted minimum temperatures represent the lower bound, thus closer to Captain Scott's original data. Therefore, my retrodictions based on pairs of data $\mathrm{McM} \xrightarrow{\text{Retrodiction}} \mathrm{SCH}$ and $\mathrm{McM} \xrightarrow{\text{Retrodiction}} \mathrm{EL}$ are due to possibly slightly higher temperatures at the McMurdo station location – the *lower bound* of expected minimum temperatures along the Captain Scott party's route.

7.4.4. Thermometers Malfunction

In Chapter 6 I presented a detailed analysis of all pertinent issues related to temperature measurements during the Captain Scott expedition. The Main Polar Party used high-quality thermometers calibrated at the Kew Observatory, London. Sling and dry bulb thermometers were used with precision. I have already mentioned there that the uncertainty of thermometers used by Captain Scott's expedition was ±0.5°F.[33] The only thermometer left after Mar. 10th, 1912 was Captain Scott's personal spirit thermometer, which was found by a search party in 1912. Charles Wright tested its calibration back in London. Test results proved this thermometer's accuracy within a tenth of a degree.[34] To reach the conclusion of thermometer malfunction, we would have to believe that Lt Bowers' and Captain Scott's thermometers malfunctioned simultaneously, that both self-corrected simultaneously on Mar. 4th, 1912, or that both thermometers were manually corrected on that day and then never corrected again despite resuming malfunctioning. Additionally, no one, including Captain Scott, ever complained about malfunctioning of the thermometers. Therefore, the explanation of the *Extreme Cold Snap* by Captain Scott's thermometer malfunctioning must be excluded.

7.4.5. Global Warming

Under the notion of long-term temperature change in Antarctica, the notion of *systematic* temperature increase is hidden. The very issue of global warming is taking its own twists and turns. It is like science has lost its initial paradigm and went public. Its merits are decided by popular vote driven by the media, rather than successive approximations. Recently, survey of quantum physics researchers was used to find their opinions "covering the main issues and open problems in the foundations of quantum mechanics".[35] The power of *global* communication is taking its own unprecedented toll.

Staying local, in Antarctica, I have to admit that, despite Article 3 of the *Antarctic Treaty*[36] concerning the freedom of exchange of information, it is extremely difficult or impossible to get meteorological data from Russian and French stations. Only the American Automated Weather Station service appears to be user-friendly, though clearly underfunded.

The whole subject of the study of the temperature changes through the past years is based on the methods of temperature data gathering, and its analysis is based on certain mathematical methods which in consequence give rise to conclusions. The most frequent analysis of past temperature records is the so-called Principal Component Analysis, PCA. The essence of the PCA method is selecting components based on their *variance*. However, before doing so, one has to confirm that the variance of a given variable *exists*. In relation to this observation, a *No-Go Theorem* for PCA has been formulated by me.[37]

Without going further into the debate over the issue of global warming, let me only recall that recent results by Steig *et al.* showed a positive warming trend in Antarctica.[38] The warming trend varies with the geographical position over the Antarctic. However, for the approximate coordinates of the McMurdo, Schwerdtfeger, and Elaine weather stations, the estimated warming trend is about 0.18°F (0.1°C)/decade. However, a new study[39] by O'Donnell *et al.* also shows average trends for the continent, East Antarctica,

and West Antarctica that are half or less than that found using Steig *et al.*'s method. I believe that the just mentioned contribution by scholars not formally related to academia (O'Donnell, Lewis, McIntyre, Condon) is a better approximation, provided that the authors will research and confirm that the variance exists.

Thus, it is fair to assume at this moment that the possible warming at McMurdo, Schwerdtfeger, and Elaine weather station is about 0.09°F (0.05°C)/decade. Since 10 decades have passed since the Captain Scott party's return journey, one could expect about 0.9°F (0.5°C) warming.

It is fair to conclude that neither calculation of warming trends contributes significantly to my overall analysis and conclusions.

7.4.6. *El Niño* Teleconnection

It was Gilbert Walker, the Director General of Observations in India, based in Simla since Jan. 1st 1904, who in a paper on world weather correlation in 1924 described the Southern Oscillation, North Atlantic, and North Pacific Oscillations.[40] The *El Niño*-Southern Oscillation is a quasi-periodic climate pattern which refers to warming or cooling of the tropical Pacific Ocean and accompanied by specific variation of air surface pressure over the same area. Since its initial discovery, the *El Niño*-Southern Oscillation somehow remains a mysterious and elusive phenomenon.

The notion of possible teleconnection between the El Niño-Southern Oscillation and Antarctica was formulated in the above-cited paper by Dr Walker[41]

> In the Ross Sea it may be inferred from the statements in 'Glaciology' on pp. 380, 386, 389, that the summers of 1907–08 and 1914–14, and probably 1901–02, were exceptionally clear of pack-ice, while those of 1910–11, 1911–12, and 1912–13, and probably 1909–10 and 1913–14, were decidedly unfavourable.

Dr Walker's initial notion that in between the year 1912 was an *El Niño* year was confirmed by later studies of the phenomenon. Despite extensive research,[42] the understanding of the relationship of the *El Niño*-Southern Oscillation and Antarctica's *climate* is far from satisfactory or even sufficient to point exactly to spatiotemporal relations.

Especially difficult is the search for a relationship of the slowly varying *El Niño* phenomenon with rapid temperature fluctuations on say, a daily basis, as in the case of daily minimum temperatures. In an exact science like physics, the understanding of rapidly or slowly varying phenomena is fairly well advanced. However, the description of transition of a given phenomenon from between these two ends is a challenging problem. The investigative reader at this instance can find many parallels between the just mentioned issue and non-extensive statistical mechanics – *Tsallis statistics* – in which the distribution functions have properties intermediate to that of Gaussian and Lévy distributions.[43]

However, for our purpose of investigating the possible influence of the *El Niño* Southern Oscillation on the appearance of the *Extreme Cold Snap*, one does not have to resort to intricate analysis, and common sense will suffice, provided that it is used in a rational way. This simple requirement, as we know from subsection 4.2.4, was

not followed by Dr Solomon with regard to many issues, but also her tantamount of weather and climate. In many cases, Dr Solomon confused the weather with climate.

In the case of the relation of the *El Niño* Southern Oscillation to Captain Scott's *Extreme Cold Snap*, Dr Solomon, to forcefully prove her case, committed a logical fallacy in exactly the opposite direction. Dr Solomon created a tantamount of climate and weather!

After describing some basic research related to *El Niño*, Dr Solomon makes two hyperbolic suggestions related to Captain Scott[44]

> It is at least intriguing and perhaps even poignant to note that March of 1912 was indeed in the El Niño phase of the cycle, and therefore consistent with such a connection – to a weather phenomenon
>
> But it is increasingly clear that both the Antarctic continental weather and key processes in its oceans do fluctuate in roughly a four-year cycle, and Scott's party struck these variable rhythms in their most unfortunate cadence.

It will remain a mystery as to why and how a slowly varying climate phenomenon (*El Niño*) was responsible for the sudden and unexpected drop of minimum daily temperatures reported by Captain Scott. In subsection 4.2.4, I discussed that issue in more detail and the reader may consult these expounds.

To summarize, I only stress that *El Niño* did not influence the Cape Evans, Hut Point, *Terra Nova*, First Relief Party, Second Relief Party, and Captain Amundsen's temperature data, and I simply reject it as a potential factor in differences between Captain Scott's temperatures and the retrodicted minimum/lowest daily temperatures.

7.5. Captain Scott's Temperature Data Fabrication

The above expounds, subsections 7.4.2–7.4.6, resulted from my search for a possible alternative to Captain Scott's data fabrication explanation, observed in Figs. 7.8 and 7.13, of large differences between the reported temperatures and the respective minimum temperatures retrodicted by my neural network.

By eliminating the alternative explanations analyzed in the preceding subsections, only one conclusion is left. That is that the temperature data reported by Lt Bowers and Captain Scott in late February and March 1912 was distorted to exaggerate and dramatize the weather conditions.

Thus, not one of the other working hypotheses formulated at the beginning of this chapter is confirmed to be true or substantiated. The degree of temperature data fabrication by Lt Bowers and Captain Scott, measured by the temperature difference between the reported and retrodicted values, depends also upon the length of time considered in the analysis.

The actual minimum daily temperatures experienced by Captain Scott in late February through March 1912 on average were *much* higher than these reported, by 17.6°F and 21.4°F respectively.

The conclusion is: Captain Scott in late February through March 1912 reported fabricated temperature data.

7.6. Particulars of Temperature Data Differences

Examining Lt Bowers' and Captain Scott's temperature data as described in the working hypotheses and/or as depicted on Figs. 7.8 and 7.13, one may get confused when and where the minimum, lowest or otherwise temperatures were used.

The above conclusion stands alone here. However, as I will show in the next two chapters, not only was the temperature record fabricated, but additionally the wind data and food/fuel shortages were falsified and fabricated by Captain Scott.

Before addressing in the next chapters the issue of the wind data and food/fuel shortages fabrication by Captain Scott, let me pause here and look at the additional hidden premises of his mortal decisions.

Returning to the most important results of this chapter depicted on Fig. 7.8 and 7.13, the following observations can be made:

- *All* temperatures retrodicted from my artificial neural network simulations are daily minimum near surface temperatures,
- The depicted temperatures and temperatures attributed to the Captain Scott party are a mixture of nightly minimum, daily lowest, and reported daily temperatures.

Since the different temperatures mentioned above, reported by Captain Scott and Lt Bowers are important for a better understanding of the results depicted on Figs. 7.8 and 7.13, I will briefly discuss them.

It is not entirely clear from the historical accounts (Captain Scott, Lt Bowers, and Dr Simpson) what minimum temperatures the Captain Scott party were accounting for. The definition of daily minimum temperature is indeed simple. It is the lowest recorded temperature within a given 24h time period, or "the maximum and minimum temperatures are the extremes for the day" as defined and published in the 1918 *Meteorological Glossary*.[45] Provided that the minimum temperature thermometer is exposed and reset every 24h, the true daily minimum temperature may be measured.

In the case of the temperature measurements at Cape Evans, this 24h requirement was indeed observed. However, for the sledging parties, including Captain Scott's party, it appears that the reported daily minimum temperatures were indeed *nightly* minimum temperatures. This conclusion comes from the deduction that during the sledging time it would be difficult (impossible) to ensure proper minimum temperature thermometer exposure: with no direct sunshine and well-ventilated air present.

For that reason, I strongly suspect that the minimum air temperatures, reported by Captain Scott and Lt Bowers, were nightly and not daily minimum temperatures. If so, and in conjunction with Fig. 3.5 showing the 24h number of occurrences of minimum daily temperatures at the Schwerdtfeger and Scott Base stations, one must observe that the minimum temperatures, reported by Captain Scott and Lt Bowers, *were not* true daily minimum temperatures.

From Fig. 3.5, one clearly observes that the vast majority of daily minimum temperatures at the above-mentioned stations occur during the night time, though the Sun is always above the horizon for 24 hours in the considered period of the year.

However, since not all daily minimum temperatures are occurring during the night, is it more accurate to call Captain Scott's and Lt Bowers' minimum temperatures as *lowest recorded temperatures*. Therefore, as depicted on Figs. 7.8 and 7.13,

Captain Scott's minimum temperatures are indeed the lowest recorded temperatures and represent the upper bound of daily minimum temperatures.

A specially constructed sling thermometer with a wooden handle was broken by Lt Bowers on Mar. 10th, 1912. From that day on, only Captain Scott's personal spirit thermometer data was available, and is carefully depicted on Fig. 7.8 and 7.13. Therefore, one should observe that the temperatures reported by Captain Scott after Mar. 10th, 1912 are not actual minimum near surface recordings, but the midday measurements: Mar. 13th, –37°F (morning), Mar. 14th, –43°F (midday), Mar. 17th, –40°F (midday), Mar. 18th, –35°F (midday?) and Mar. 19th, –40°F (daytime?).[46]

Since we are concerned with daily minimum near surface temperatures, an important question arises. Is it possible, on the basis of several or say one temperature measurement(s) during a certain day, to recover (find) the minimum temperature for that particular day?

Nothing is that simple, however, as one could use an artificial neural network, as presented in my work, to perform the learning and retrodicting of the respective temperatures on the basis of simultaneous temperature measurements at the McMurdo weather station.

However, I will not venture into such calculations at this time. Even if the calculations are performed, they will not add much to my conclusions. Instead, some pertinent comments are applicable here.

If one consults Figs. 3.4 and 7.3, it is evident that in most cases the difference between midday and daily minimum temperatures is significant. It was Dr Simpson[47] who analyzed the daily variation of temperature at the Barrier, and who pointed out that it is vital to account for a 24h temperature dependence and that the minimum temperatures usually occurred around midnight. Although this relationship is not universal, by using a polynomial fit of the data from the modern temperature records at Schwerdtfeger station, I have estimated that the average difference between midday and midnight temperatures in March is about –12.5°F. If I accept this at face value, then all the temperature records of Captain Scott after Mar. 10th, with the exception of Mar. 13th, and possibly Mar. 19th, a correction of about –12.5°F must be introduced. Thus, according to Captain Scott the average minimum near surface air temperature in the period of Mar. 10th through Mar. 27th, 1912 was a dramatic more than –50°F. Indeed, a staggering figure.

⋮

The insightful reader may notice from Fig. 7.8 that the Mar. 4th minimum near surface temperature reported by Captain Scott is much higher than all the remaining temperatures between Feb. 27th through Mar. 27th. Coincidently, the Mar. 4th temperature spike (–24°F) is very close to the temperature (–21.9°F), retrodicted by me for this particular day. On this particular day, Lt Bowers recorded: 5am/–24.3°F, 1pm/–13.5°F, 9pm/–25°F and minimum temperature –24°F.[48] But a sudden increase in temperature started the day before: 5am/–41°F, 1pm /–13.8°F, 7.30pm/–15.5°F.

The rise in temperature by 27°F on Mar. 3rd, within 8 h without a change of wind direction or speed, is an *extraordinary* meteorological event in Antarctica, especially from the perspective of Captain Scott's worn down party. And yet no one in the party, including Captain Scott, commented on it on that day. Only on the next day (Mar. 4th), did Captain Scott casually add in his journal

> For the moment the temperature is –20°, an improvement which makes us much more comfortable, but a colder snap [*sic*] is bound to come again soon.

The phraseology of this ruling and its logic is an interesting one, especially if one remembers Captain Scott's famed *Message to the Public* and the explanatory line

> no one in the world would have expected the temperatures and surfaces which we have encountered at this time of the year.

Until automated weather stations were installed, no meteorological data was available for analysis of all-year round weather conditions on the Ross Ice Shelf. However, in spite of that, *Heroic Age* explorers, as well as the scientists accompanying them, by assuming spatiotemporal continuity of meteorological events could gain insight into the question. James Murray, a biologist of Lt Shackleton's *Nimrod Expedition* (1907–09), used weather data from all previous Antarctic expeditions and produced an interesting figure of yearly change of coastal temperatures, Fig. 3.6. This summary was known to Dr Simpson, who together with Captain Scott and Dr Wilson, were planning the South Pole attempt.

Their analysis was summarized by Dr Simpson in the first volume of *Meteorology* of the *Terra Nova Expedition* and critically reviewed in Chapter 3. The estimated *difference* in the mean temperature at McMurdo Sound (Cape Evans) and One Ton Depôt was about –21.4°F for the month of March.[49] Knowing the mean temperature at Cape Evans for March, which was about +4.4°F, Captain Scott should have expected the mean temperatures for the entire month of March to be about –17°F in the proximity of One Ton Depôt. Of course, we know from Chapters 3 through 5 that such reasoning is not climatological, but rather a statement reflecting the analysis of temporary weather data from the few years which were available.

Pending a steady seasonal gradient of temperatures (see Figs. 7.1 and 7.2), one would anticipate slightly higher temperatures at the end of February and early March. None of that happened. On the contrary, there was a never ending cold snap and cold outbreak. The rise of temperatures on Mar. 4th was "an improvement" as Captain Scott noticed, but not a return to the expected air temperatures. Captain Scott's description of meteorological events in the *Message to the Public* and the actual events described in his journal at the beginning of March 1912 are somehow contradictory. In the *Message*, Captain Scott informs the public that "no one in the world would have expected the temperatures," but in the journal entry on Mar. 4th Captain Scott *predicts* that after a short warming on Mar. 4th "a colder snap is bound to come again soon." This discrepancy is puzzling. Captain Scott is talking without speaking.

On another occasion, almost exactly three months earlier, just at the entrance to the Beardmore Glacier, Captain Scott's South Pole party was stopped and held in the tents for four long days by a blizzard, or gale as he called it in the *Message to the Public*. Captain Scott asked, "What on earth does such weather mean at this time of year?" and wondered:

> Is there some widespread atmospheric disturbance which will be felt everywhere in this region as a bad season, or are we merely the victims of exceptional local conditions? If the latter, there is food for thought in picturing our small party struggling against adversity in one place whilst others go smilingly forward in the sunshine.

⋮

In addition to the particularities of temperature records during his South Pole journey as discussed above, it is clear that Captain Scott, in his letter to Kathleen Scott, informed her:

> Dear it is not easy to write because of the cold –70 degrees below zero [*sic*] and nothing but the shelter of our tent …

Indeed, Captain Scott's –70°F figure is staggering, and cannot be read without noting its incredulity. From the way he wrote this particular letter, one can be certain that Captain Scott was in good mental health. Was he sure that his journal was telling the whole story he wanted, without inconvenient competition from his own letter? Was Captain Scott assuming that his private letter would never surface?

7.7. Synopsis

In this chapter, I presented my main results concerning Captain Scott's meteorological record during the *Terra Nova Expedition*. I was concerned with the analysis of Captain Scott's temperature record in February and March 1912.

The weather patterns in Antarctica are neither completely regular nor completely irregular. These weather patterns are rather a self-organized criticality. I have not arrived at these conclusions by analyzing logical structures of particular weather descriptions from original journals. In this chapter, I have arrived at the conclusions presented because I have rigorously and scientifically analyzed modern and historical weather data. All modern meteorological data, as well as the historical data of Cherry-Garrard's First Relief Party, has shown high correlations between the temperatures at different locations at the Ross Ice Shelf, and precise retrodiction of modern and historical data all point to the oddity of Captain Scott's temperature recordings from late Feb. 27th through to Mar. 27th, 1912. On the basis of the above-mentioned evidence, I conclude that the actual minimum near surface temperature data was altered by Lt Bowers and Captain Scott to inflate and dramatize the weather conditions.

Chapter 8

March 21st through 29th, 1912 – Never-Ending Gale?

The Smithsonian National Postal Museum[1]

In the previous chapter, I presented an analysis of the weather events described by Captain Scott in his journal and in his *Message to the Public*. Based on the presented analysis, I concluded that both the *Extreme Cold Snap* (Feb. 27th through Mar. 19th) and *Super Extreme Cold Snap* (Feb. 27th through Mar. 27th) did not occur, and were fabricated by Captain Scott. The reasons for these fabrications will be presented and discussed in Chapter 12.

During the final weeks of February and March 1912, Captain Scott not only reported oddly low temperatures as I discussed in the previous chapter. On Mar. 21st, Captain Scott conveys in his journal

> Got within 11 miles of depôt Monday night; had to lay up all yesterday is severe blizzard. To-day forlorn hope, Wilson and Bowers going to depôt for fuel.

For the next two days, Mar. 22nd and 23rd, his diary continues

> Blizzard bad as ever – Wilson and Bowers unable to start … – must be near end.

It was well known from explorers' experience that blizzards in Antarctica can last for a few days. Captain Scott in the *Message to the Public* adds the comment

> We arrived within 11 miles of our old One Tone Camp with fuel for one last meal and food for two days. For four days we have been unable to leave the tent – the gale howling about us.

In the last entry on Mar. 29th, Captain Scott wrote

> Thursday[2], March 29. – Since the 21st we have had a continuous gale [*sic*] from W.S.W. and S.W. Every day we have been ready to start for our depot 11 miles away, but outside the door of the tent it remains a scene of whirling drift.

The investigative reader may note from Captain Scott's own descriptions, or from Dr Simpson's meteorological record and analysis, that frequently observed gales accompanied with blizzards at the Ross Ice Shelf last about one–two days. Thus one or two days are to be expected, but nine or ten days?

Were the laws of physics suspended at the end of March 1912 in Antarctica? Did the suspension happen for a second time, just after the Party went through the *Extreme Cold Snap* and *Super-Extreme Cold Snap*? Did it occur only at the actual location of Captain Scott's team, and not occur at other locations, where simultaneous measurements and observations were being taken by other members of the *Terra Nova Expedition*? These are perplexing questions, indeed.

8.1. Nature of Near Surface Winds in Antarctica

Over the years, the cross-scale analysis of various natural phenomenon attracted much attention, with a special interest given to bridge spatiotemporal description of interdisciplinary catastrophic or rare events. These disturbances are in different degrees spatially and temporally characterized by aggregate variables, for example amplitude, frequency, period, and seasonality. Although the wind is a vector quantity and may be measured and processed as such, it is common to measure and/or process the scalar components of the wind vector separately; *i.e.*, wind speed (the magnitude of the wind vector), and wind direction (the orientation of the wind vector). Wind direction is generally defined as the orientation of the wind vector in the horizontal. The direction of wind for meteorological purposes is defined as the direction from which the wind is blowing, and is measured in degrees clockwise from true north.

Wind is a complex physical phenomenon occurring in Earth's atmosphere, and its behavior is discussed in Chapter 1. It was shown there that it is useful to look at the wind as a wind-event structure: the wind blows or it does not. Consequently, the following wind events were defined and analyzed: a cumulative size distribution, wind duration distribution, wind quiescent distribution related to the duration of a wind event, and duration of a quiescent wind event.

Presented analysis of wind events for some 36 weather stations across Antarctica confirmed that near surface down-slope horizontal pressure-gradient katabatic winds driven toward coastal fringes of the continent are a self-organized criticality. This self-organized criticality is observed for the size, duration, and quiescent time of wind events. The general properties and behavior of self-organized physical systems were discussed in section 1.4. Figs. 8.1 and 8.2 illustrate, plotted in $\log_{10}$-$\log_{10}$ scale, a self-organized criticality of the duration of wind events and of quiescent wind events size recorded at the weather stations across Antarctica, as listed in the Appendix to Chapter 8 – Scaling Parameters of Wind in Antarctica. This appendix provides a summary of scaling parameters of wind event size (α_s), wind event duration (α_t), and wind event quiescent duration (α_q) for different locations in Antarctica.

While plotting wind data on Fig. 8.1 and 8.2, I have used "raw" data from all listed weather stations. These plots, especially for long-term wind events, may contain artifacts due to the measuring method and the way I calculated wind event duration. Let me recall that the wind event size $w_s = \int v(t)dt \approx \sum v(t)\Delta t$ was calculated for *successive non-zero* wind velocity, where Δt is the size of the measurement bin. While

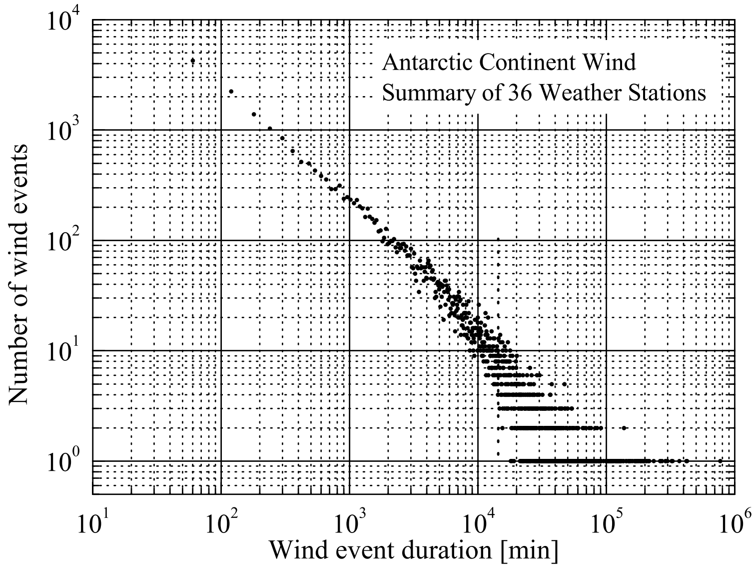


Figure 8.1. A summary of the number of wind events *vs.* wind event duration for the "raw" wind velocity data from 36 weather stations across Antarctica. The unity of wind event size w_s is given in [m(metre)] which results from the definition $w_s = \int v(t)dt \approx \Sigma\, v(\Delta t) \times \Delta t$ and $\left[\Sigma\right] = \left[\dfrac{1\ \text{m(metre)}}{1\ \text{s(second)}}\right] \times \left[1\text{s (second)}\right] = \left[1\text{m (metre)}\right]$. The wind event size is related to wind energy dissipated during the wind event.

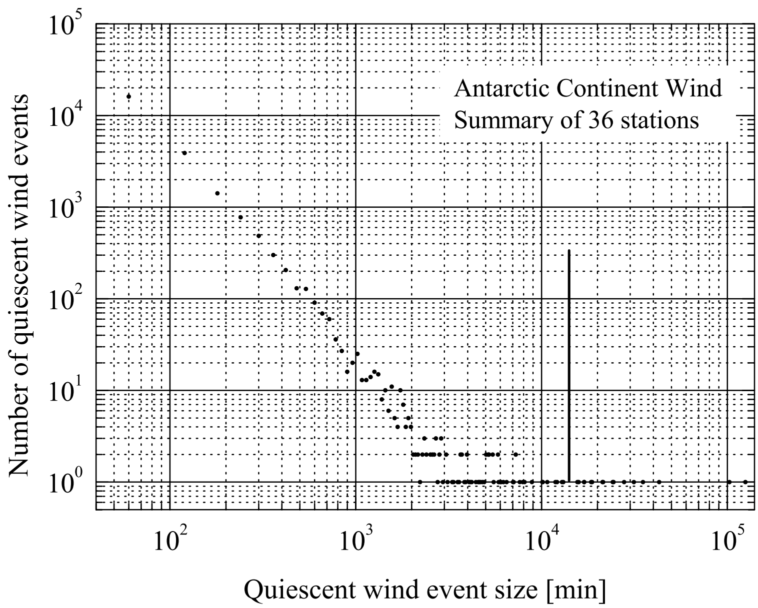


Figure 8.2. A summary of the number of quiescent wind events *vs.* quiescent event size for the "raw" wind velocity data for 36 weather stations across Antarctica. See Fig. 8.1 caption for additional explanation.

looking at a chain of wind velocities, the time, say t_1, at which $v(t_1) = 0$ represented the beginning of wind event and the next time, say t_2, at which $v(t_2) = 0$ represented the end of this particular wind event.

It is well known that every different wind vane (aerovane) model manufactured by different producers has a different starting threshold and starting accuracy. These three variables may affect the proper detection of wind velocities, especially when $v(t) \to 0$ [3]

1. Starting threshold,
2. Delay distance,
3. Overshoot ratio.

Therefore, the $v(t) \to 0$ threshold of wind event may be imprecisely measured and calculated. Thus, some zero wind velocity cut-off parameter should be considered.

8.2. The Never Ending Gale

Since the *Never Ending Gale* struck Captain Scott's party at close proximity to One Ton Depôt, the modern wind data measured by the Schwerdtfeger AWS, as well as the Antarctica New Zealand Scott Base, henceforth Scott Base, are usable for comparison. In my analysis, I used 26 years of wind data (including years with incomplete data) measured at Schwerdtfeger and at the Scott Base[4] station located at the southern tip of Hut Point Peninsula of Ross Island, Antarctica. Due to the Ross Ice Shelf air stream as depicted on Fig. 1.7, New Zealand's Scott Base is directly "facing" all meteorological events at the Ross Ice Shelf.

Both Scott Base and Schwerdtfeger stations are not exceptions to the self-organized criticality of wind events shown in the above preceding section. Wind event size distribution at Schwerdtfeger station shows typical power-law behavior, with the scaling parameter $\alpha_s = 1.27 \pm 0.01$. Similar wind size scaling parameters calculated for the Scott Base and McMurdo stations are $\alpha_s = 1.13 \pm 0.01$ and $\alpha_s = 1.31 \pm 0.07$, respectively. See Tab. 1.2 for wind scaling parameters for these stations.

Up until recently, the belief that an arbitrary size wind event may happen in Antarctica was taken for granted by polar enthusiasts and authors. Although the nine/ten-day *continuous* gale at the end of March 1912, described by Captain Scott, was indeed an extraordinary event, no one bothered to look at meteorological data with the exceptions of Dr Solomon and the author of this book.

Yet again, it is not surprising to observe that Dr Solomon produced a fallacious account resulting from fabricating false wind velocities and attributing them to Captain Scott. I already analyzed and discussed Drs Solomon and Stearns' wind data dragging presented in the paper published in the Proceedings of the National Academy of Sciences (USA) (PNAS) in subsection 4.1.2. By deliberately lowering the reported by Captain Scott gale [*sic*] wind (62–74 km/h) velocities to 30 km/h (fresh breeze 28–38 km/h), Drs Solomon and Stearns happily produced the obscure conclusion that "Hence, windy conditions do not appear to be highly unusual for this location and time of year." and thus in their and the readers' understanding, they confirmed the fact that Captain Scott was struck by the *Never Ending Gale* – Mar. 21st through 29th, 1912. In summary, Drs Solomon and Stearns confirmed Captain Scott's account of

the 9 to 10-day blizzard of gale strength, the "storm [*sic*][5] " which "ended the attempt to continue marching at a site about 11 geographical miles"[6] from One Ton Depôt.

As we know, Dr Solomon followed her PNAS fallacious account with a book publication (see Chapter 4). Addressing the question of the *Never Ending Gale* seemed unavoidable. Dr Solomon's account of the *Never Ending Gale* in her book further proves her hypocrisy and disregard to readers. Dr Solomon, like David Copperfield (with due respect), can prove whatever she wishes to prove by cherry picking certain data.

I have shown above, that due to the evident scaling property of wind event size at Schwerdtfeger and the remaining stations/locations, it can be argued that at this particular location, which is very close to the last camp of Captain Scott's party, an *arbitrary* wind event size is certainly possible. Thus, one can attempt to make a scholarly inference based on the above analysis of the scaling properties of wind events, suggesting the nine/ten days gale reported by Captain Scott did indeed take place.

However, such a conjecture is not correct. The occurrence of an arbitrary wind event size is only a theoretical possibility that a valid power-law relationship $p_s(w_s) \propto w_s^{-1.27}$ exists at Schwerdtfeger station, without physical limits or underlying physics laws.

On a grander scale than the Schwerdtfeger location, I have shown above that wind reaches a state of self-organized criticality over the whole Antarctic continent. The movement of the wind takes place within the polar cell boundary, and the transported pool (mass) of air is limited and must be conserved. Therefore, no arbitrary wind event size can be observed.

Another important and limiting factor is the time needed to pass, in order for the observer to note an arbitrary sized event. And the third factor is that wind events at the Ross Ice Shelf are interconnected. This means that whatever size wind event occurs at, for example, the Schwerdtfeger location, a similar in size (though delayed in time) event occurs at the Scott Base and McMurdo station. Similar interconnections were found between changes in near surface air temperatures at these locations.

Captain Scott reported that on Mar. 21st through 29th, 1912, a *continuous blizzard of gale force* confined the party in the tent. It is fair to assume that Captain Scott, as a Royal Navy officer, was well trained and acquainted in describing wind force according to the Beaufort scale.[7] In this empirical measure, wind velocity in the range of 17.2–20.7 m/s (≈62–74 km/h) is named a *gale* – Beaufort number 8. Captain Scott used the term *gale* or *moderate gale* 59 times in his journal. Whenever it was possible, I checked Captain Scott's description against the *Terra Nova*'s or Dr Simpson's records. I confirmed that Captain Scott's description of wind events was accurate, with only *one* exception: the gale of Mar. 21st through 29th, 1912.

The Beaufort scale was a standard for ship log entries on Royal Navy vessels in the late 1830s. The Beaufort scale is rather a phenomenological scale.[8] The biggest pitfall of this scale is the lack of a time frame at which a given wind velocity has to be sustained in order to fall into a given category. Wind gusts and continuous fluctuations additionally complicate the issue, and self-organized criticality of wind events should be reflected in a new (yet to be described) wind velocity scale.

Nevertheless, I have assumed that if within a 24h timeframe at least one recorded wind velocity was equal or higher than the lower bound gale velocity (17.2 m/s ≈62 km/h), then an entire 24h frame would be called a *gale-day*. If two gale-days were recorded in two, three, … *consecutive* days, then such wind event is called a two-day

gale, three-day gale, *etc*. This assumption is truly a very moderate one, as a single wind gust would make a gale-day.

Due to the above-mentioned scaling properties of wind events, some observations can be made about the longest possible wind event at the location of Captain Scott's last camp in the proximity of One Ton Depôt. The assumptions would then apply to events close to the modern Schwerdtfeger weather station. By taking into account the *whole* available record of wind data (1986 through 2011), I found that the longest and strongest wind event ever recorded there occurred between Nov. 1st through Nov. 13th, 2004. The wind velocity structure of this event is depicted on Fig. 8.3. The duration of a wind event is understood as a continuous record of a wind velocity of $v > 0$ m/s, with a detection threshold of about 0.1 m/s.

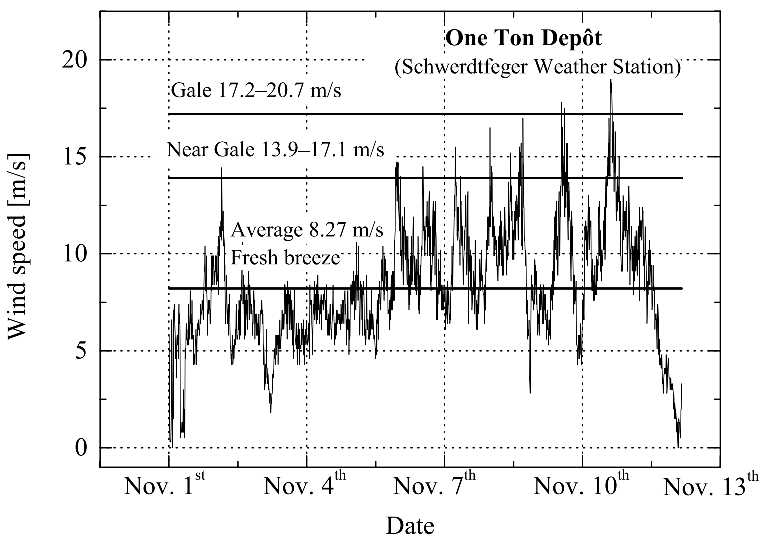


Figure 8.3. The longest and strongest wind event to ever occur at Schwerdtfeger station (One Ton Depôt), between Nov. 1st through Nov. 13th, 2004.

The Nov. 1st through Nov. 13th, 2004 wind event, which lasted thirteen consecutive days, had a few important characteristics. First of all, there was an extremely fast wind escalation (rise).[9] For an observer from the ground, it appeared as a wind blast. The second important characteristic was the "wave structure" of the wind velocity changes. And the third was the sudden downfall of wind.

To illustrate Captain Scott's wind record, I have also shown the lower bound of the Beaufort scale for winds of gale, near gale, and fresh breeze strength on the same figure (Fig. 8.3). The implications from this comparison are rather palpable. Captain Scott claimed that at their final camp – about 11 miles from One Ton Depôt – his party encountered a nine/ten-day continuous gale. It is self-evident from Fig. 8.3 that it is stretching the meaning to call this most severe recorded wind event a gale. There are only two wind *gusts* (spikes) on Fig. 8.3, which hardly and briefly reach gale force. Lowering the Beaufort scale to near gale force on the same figure shows that the biggest wind event still can hardly be called a near gale event.

The following definitions[10] may be useful to recall how the Beaufort scale is related to land conditions (for more see also Fig. 4.6):

Fresh Breeze – Branches of a moderate size move. Small trees in leaf begin to sway,
Near Gale – Whole trees in motion. Effort needed to walk against the wind,
Gale – Some twigs broken from trees. Progress on foot is seriously impeded.

In Antarctica, the wind creates a near surface drag force. This force drives sweeps into the air those snow grains which are deposited on the surface. This creates the conditions of what is called a blizzard. Blizzard conditions are those in which visibility and contrast are severely reduced.

According to Captain Scott's last entry in his field journal on Mar. 29th, 1912, the combined conditions of a nine/ten-day gale with blizzard conditions was to blame for their failure to reach the One Ton Depôt. In particular, Captain Scott comments, "Every day we have been ready to start for our depôt 11 miles away, but outside the door of the tent it remains a scene of whirling drift."[11]

The biggest wind event presented in Fig. 8.3 was rather a fresh breeze. Such a breeze is well below the wind velocity of a gale. Thus, the biggest wind event recorded by a modern weather station, at the proximity of One Ton Depôt, was about two times smaller than the event reported by Captain Scott back in March 1912, and it took place in *November*, not in March.

In modern data, it is not difficult to find the biggest wind event to ever take place in the month of March at Schwerdtfeger weather station. The event was *coincident* with Captain Scott's record, as it took place between Mar. 24th through 31st, 1994, and is depicted on Fig. 8.4. This wind observation from March 1994 further confirms that the nine/ten-day gale described by Captain Scott was much greater in length and force than any wind observed on modern record. This particular wind event,

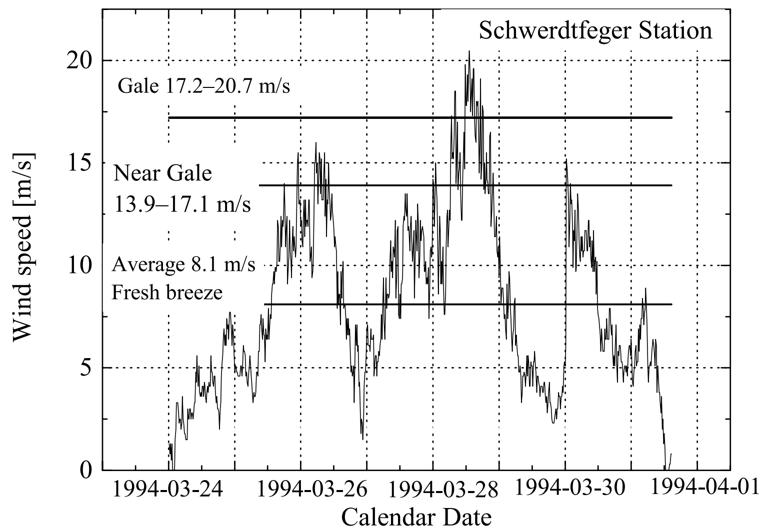


Figure 8.4. The biggest wind event ever recorded at Schwerdtfeger weather station (One Ton Depôt) in the month of March. The event was recorded between March 24th through 31st, 1994.

Mar. 24th through 31st, 1994, also reveals an already described feature of all wind events in Antarctica. This characteristic is a sudden rise and downfall of the wind, separated by frequent wind humps. These wind humps are long-term fluctuations of wind velocity. The definition of a blizzard, provided by the National Oceanic and Atmospheric Administration,[12] requires *sustained* gusts of gale force or greater, and blowing (falling) snow which reduces visibility to less than ¼ mile.

Returning to Figs. 8.3 and 8.4, it can be noted that within these extreme wind events, one can select two different time windows: above the fresh breeze line, and below the fresh breeze line. According to this definition, the conditions and the time "spent" by wind events below the fresh breeze line cannot be regarded as blizzard conditions. More importantly, when the weather conditions below the fresh breeze line are favorable, travel is thought to be possible although challenging (see Lt Bowers' wind data collected in Dr Simpson Vol. III, *Table 72. Register of the Main Polar Party, Cape Evans to Pole and Back to 80°S*). Looking at Fig. 8.4, it may be concluded that although this longest and strongest wind event lasted about 4 days (96h), there were – from the sledging point of view – encouraging weather conditions about half of the time. Thus, a distance of about 22 miles (see section 10.6 *The 11 Miles Myth*) could have been travelled by Captain Scott's sledging party. Obviously, the day & night routine would have to have been changed to a "pitch a tent and go when you can" schedule. Exactly the same observation can also be made from the biggest ever recorded wind event at Schwerdtfeger station (One Ton Depôt), Nov. 1st through Nov. 13th, 2004. Therefore, the immobility of Captain Scott's party due to the nine/ten-day gale from Mar. 21st through 29th, 1912 is dubious.

Let me investigate the next question of how many days a gale may last at the Ross Ice Shelf. A definition of gale-days was given above, and a similar assumption is made in relation to weaker, near gale (13.9 m/s ≈50 km/h) wind events.

Fig. 8.5 depicts the total number of consecutive gale-days recorded at the Schwerdtfeger and Scott Base weather stations, for every month of March from 1985 through 2011. A wealth of knowledge is depicted in this figure. From my point of view, and in relation to Captain Scott's record, it can be seen that in all the analyzed months of March (Fig. 8.5, C & D), the longest *consecutive* gale and near gale winds lasted for three (3) and four (4) days, respectively. That is *far* below the black swan nine/ten-day gale reported by Captain Scott. Figure 8.5 provides the second argument against Captain Scott's record of a nine/ten-day long gale in late March 1912. The gigantic gale winds (and thus, the blizzard) reported by Captain Scott are of unfounded proportions.

The investigative reader must also observe here that Fig. 8.5 represents the upper bound of what could be defined as gale-days. Even one recorded gust with an instant recorded velocity above Beaufort scale 8 made the entire day count as one gale-day. This observation is confirmed by examining wind data which contributed gale-days to the respective wind event counts, as presented in Fig. 8.5. Consequently, this is in agreement with the wind event depicted in Fig. 8.4. There is no such wind occurrence of "continuous gale" and/or near gale wind event as Captain Scott observed on Mar. 29th. In an ordinary sledging situation, the wind event as depicted in Fig. 8.4 may result in a sledging party's decision to pitch a tent for 4/5 days. However, in life-threatening situations, like say a necessity of reaching One Ton Depôt, it is evident from Fig. 8.4 that during certain periods of time, the wind velocity did not prohibit sledging.

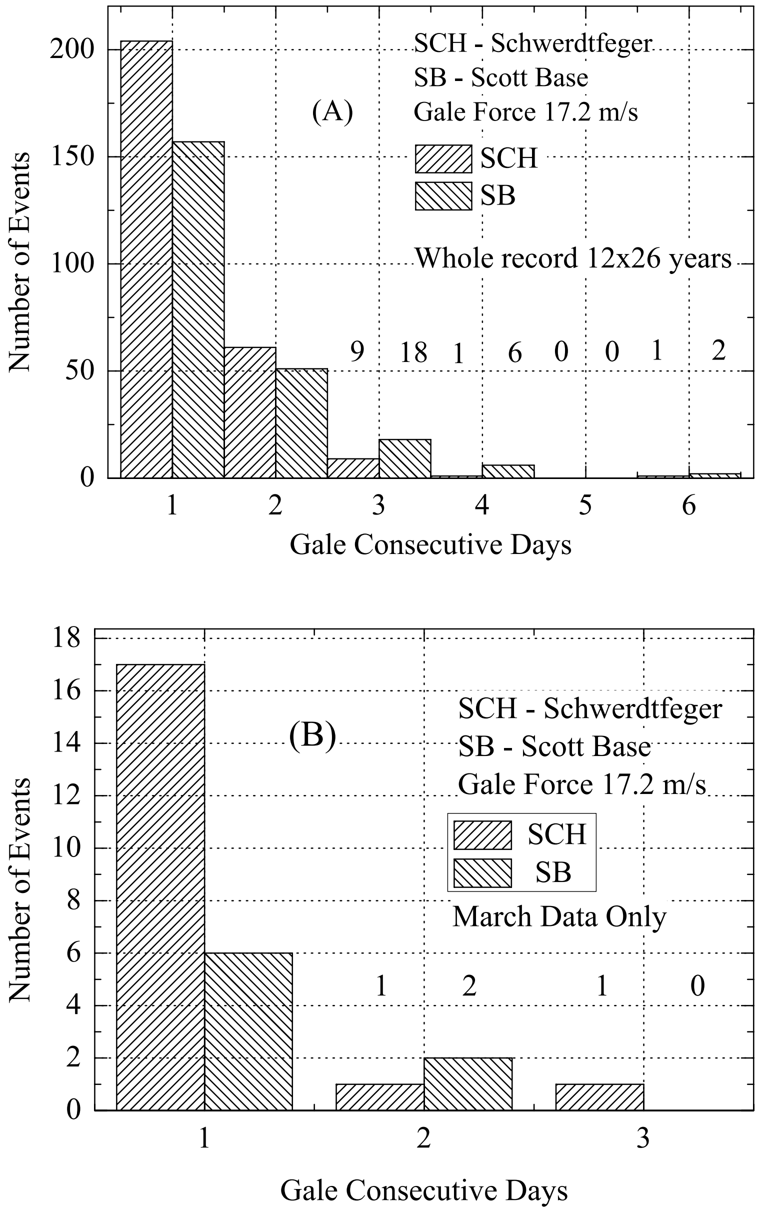


Figure 8.5. The total number of consecutive gale-days recorded at Schwerdtfeger (One Ton Depôt) and Scott Base weather stations, for the whole record, and for every month of March from 1985 through 2011.

The wind velocity is one thing, but another thing associated with it is the blizzard's other condition of blowing snow. Even at low wind velocities, associated blowing snow could represent a serious challenge to sledging party. But in what sense could even a low wind velocity blizzard prohibit the sledging party from advancing?

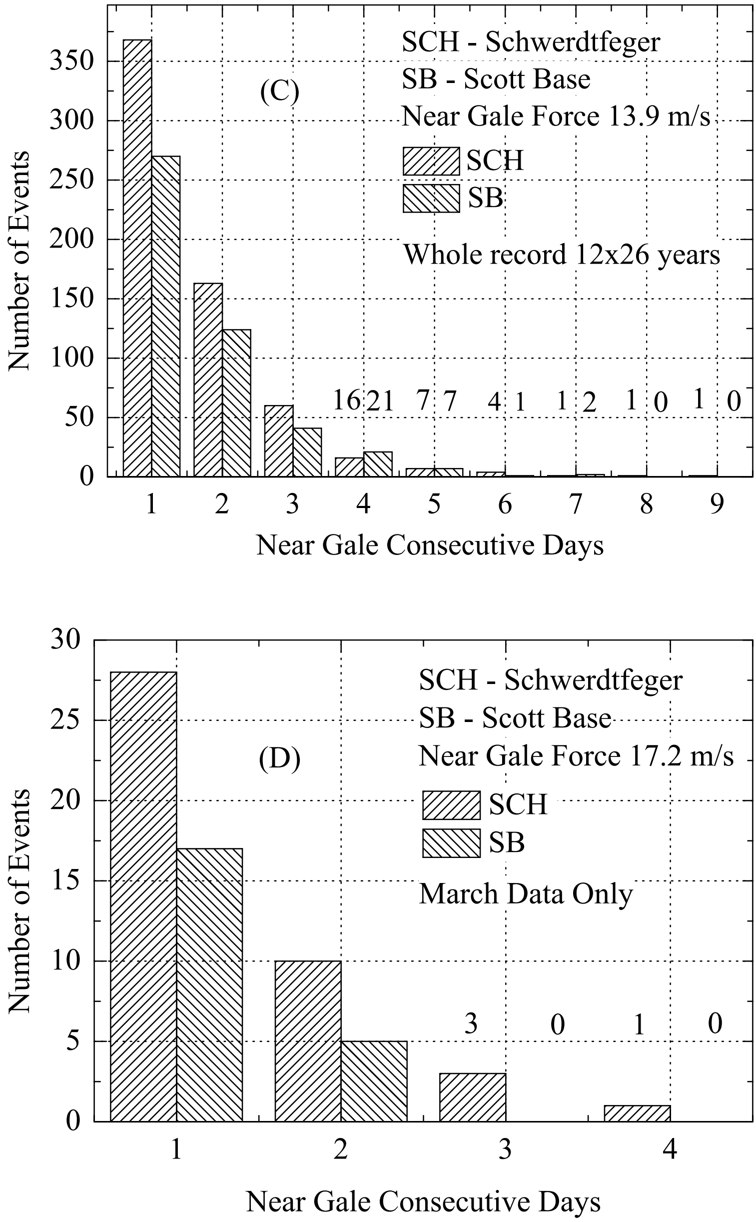


Figure 8.5. Continued.

Provided that the party did not cross and fatally fall into new crevasses on the Barrier, and provided that the wind velocity was not too great to prohibit marching, my thesis is that each returning party, including Captain Scott's party, could sledge *through the mild blizzards* (virtually blindfolded) and reach each depot, including One Ton Depôt. By the fact that the party could be blindfolded and still sledge in a certain direction, I understand that the blizzard could completely forbid them to navigate

using their sight and/or optical instruments (theodolite). Subsection 11.1.5, titled *Navigation and Navigation Methods*, provides a comprehensive proof of the above thesis that the expedition's principal method of navigation method, as per Captain Scott's orders, was the ability of each officer taking a part in the *Southern Journey* to sledge by variation of the compass. Thus, by steering with the compass and following magnetic declination with a fixed rate of change for it about 152° (positive East and in 1912) along 170°E (see Fig. 11.7 and Captain Scott's journal entry Feb. 21st, 1911), one can safely navigate through the mild blizzards and return to Hut Point (Corner Camp).

However, Captain Scott was not interested in sledging to Hut Point, and *already* on Mar. 16th/17th declared where and how his party diaries and belongings would be found

> We are at No. 14 pony camp, only two pony marches from One Ton Depôt. We leave here our theodolite, a camera, and Oates' sleeping-bags. Diaries, &c., and geological specimens carried at Wilson's special request, will be [*sic*] found with us or on our sledge.

In the previous chapter, I have analyzed Captain Scott's false reporting of the *Extreme Cold Snap* and *Super Extreme Cold Snap*, which lasted from Feb. 27th through Mar. 27th, 1912. Now we see that despite these fabrications, Captain Scott felt obliged to throw in the *Never Ending Gale* to explain his inability to sledge southward. According to Captain Scott, "the storm which has fallen on us" at the proximity of 11 miles from One Ton Depôt prevented them "to secure [our] final supplies".[13]

On Mar. 26th, the Second Relief Party, consisting of Dr Atkinson and Keohane, started out alone from Hut Point to supposedly search for and help Captain Scott's party. Neither of them could handle dog sledging and they resorted to the standard man-hauling technique. Their progress was unexplainably *very* slow, only nine miles per day. The party travelled only to a point eight miles south of Corner Camp, where Dr Atkinson recorded: "At this date [Mar. 30th, –KS] in my own mind, I was morally certain that the party had perished"[14]. Dr Atkinson's conjecture is surprising, both because of its appeal to moral issues and its *post factum* character. An elementary calculation of the possible arrival time of Captain Scott's party, with a number of updates resulting from information provided by returning parties, would give to Dr Atkinson an arrival date for Captain Scott's party of Mar. 30th (at Corner Camp, ~12 miles (~19 km) from Hut Point), which clearly questions his moral confidence (see section 10.4).

After leaving Hut Point, Dr Atkinson and Keohane's party was fully exposed to the air stream flowing northward along the Transantarctic Mountains.[15] Due to the already shown high correlations of temperatures and wind velocities along Captain Scott's route, including Dr Atkinson and Keohane's course, both parties should have experienced the same or very similar weather conditions.

In the small Tab. 8.1, I have presented the weather Register of the Second Relief Party (Dr Atkinson and Keohane). It is self-evident from this table, that the weather conditions recorded by Dr Atkinson were *mild*. On March 26th, Dr Atkinson observed, "The temperature was exceedingly low but the weather fair."[16] From Mar. 27th through Mar. 30th, he recorded a wind force between 1 to 3 in the Beaufort scale (light air-gentle breeze). Thus, the strongest wind observed by the relief party was a gentle breeze; leaves and small twigs constantly moving, according to the Beaufort scale description.

Table 8.1. The weather Register of the Second Relief Party – Atkinson and Keohane.[1]

Date	Time	Dry Bulb Temperature [°F]	Wind Force	Minimum Temperature [°F]
Mar. 27th	14:30	+2.5	3	–
	17:30	–3.5	3	–
Mar. 28th	7:00	–6.5	2	–6.0
	12:30	–15.5	3	–
	17:00	–6.5	1	–
Mar. 29th	7:00	–3.5	1–2	–13.0
	12:30	–0.5	-	–
	17:30	–0.5	1–2	–
Mar. 30th	7:00	–8.5	1–2	–16.0
	12:00	–3.5	3–4	–
	17:30	–5.5	3–4	–
Mar. 31st	7:00	–13.5	3–4	–13.0

1 George C. Simpson, *British Antarctic Expedition 1910–1913: Meteorology*, Vol. III, *Tables*, Harrison and Sons, Ltd., London, 1923, *cf.* p. 678.

Comparing these conditions, and the analysis of wind duration and strength as a raging gale at One Ton Depôt, the conclusion is that Captain Scott's wind record was highly inaccurate. The second black swan meteorological event did not take place.

There are two side issues which one may use to argue against my confirmation that Captain Scott invented the nine/ten-day gale. These issues include the possibility that during his final days, Captain Scott lost his ability for a reasonable, healthy judgment of reality due to his physical and mental state. There is no question that Captain Scott suffered greatly. There is no question that he was not sure about the actual date. Dr Wilson, Lt Bowers and possibly Captain Scott were likely uncertain whether the date was 21st or 22nd Mar. However, even if we assume this 'one day of uncertainty' as a fact, it is obvious according to my analysis that a *gale* that was one day shorter also never occurred.

Captain Scott wrote a number of farewell letters, a *Message to the Public*, and a couple entries in his Journal during the last days of March 1912. All of these writings, their style, and finally the fact that they were written in his usual handwriting, confirm, at least up to this heartbreaking moment, that in fulfillment of his words "It seems a pity, but I do not think I can write more," Captain Scott was able to reasonably and rationally judge reality.

This presented analysis could be refined by usage of the mathematical technique called the *Hilbert transform*. It would enable one to show that due to the Ross Ice Shelf air stream, and due to the fact of rapid wind velocity rise for considerable wind event size, the "gale blizzard front" at Schwerdtfeger AWS would be recorded after a delay at Scott Base. My preliminary calculations confirmed that the significant size blizzard front at Schwerdtfeger AWS was followed with about a 4h delayed blizzard

front obtained from the Hilbert transform at Scott Base. This further confirms that the recorded mild wind conditions by Dr Atkinson confirm that Captain Scott's nine/ten days continuous gale did not take place.

8.3. Synopsis

Polar historians and enthusiasts are aware that toward the end of March 1912, Captain Robert F. Scott reported in his journal a meteorological event, which was extraordinary as far as its length and strength was concerned. This event was the *gale*, which according to Captain Scott lasted *continuously* for nine/ten days. Were the laws of physics suspended at the end of March 1912 in Antarctica? I have shown that the near surface winds in Antarctica are a self-organized criticality and that the winds over the continent form an ergodic system. I have presented an analysis of wind events in the proximity of Captain Scott's camp and at Ross Island. By comparing wind events at these locations, and performing an analysis of a gale's wind duration and strength at One Ton Depôt, I concluded that Captain Scott's wind record was highly inaccurate. I concluded that the nine/ten-day gale described by Captain Scott that lasted from Mar. 21st through 29th did not take place. This result, combined with previous analysis of Captain Scott's temperature record (Chapter 7), shows that three black swan meteorological events: Feb. 27th through Mar. 27th, 1912 – *Extreme Cold Snap* and *Super Extreme Cold Snap*; and Mar. 21st through 29th, 1912 – *Never Ending Gale* reported by Captain Scott, did not take place.

These two meteorological fabrications do not exhaust the list of Captain Scott's manipulations with his party's data and state. In the following chapters, I will uncover even more disturbing facts about Captain Scott's party and expedition.

8.4. Appendix to Chapter 8 – Scaling Parameters of Wind in Antarctica

Summary of scaling parameters of wind event size (α_s), wind event duration (α_t) and wind event quiescent duration (α_q) for different locations in Antarctica.

Station	α_s	$\pm\Delta\alpha_s$	α_t	$\pm\Delta\alpha_t$	α_q	$\pm\Delta\alpha_q$
Amundsen-Scott	–0.06	±0.35	–0.92	±0.09	–2.19	±0.06
Bonny	–0.54	±0.03	–1.15	±0.05	–2.47	±0.06
Cape Bird	–0.24	±0.12	–0.50	±0.03	–2.80	±0.10
Cape Denison	–	–	–0.87	±0.08	–2.02	±0.08
Carolyn	–0.40	±0.09	–1.14	±0.03	–1.65	±0.03
Casey	–0.43	±0.05	–1.03	±0.03	–2.43	±0.08
Concordia	–0.48	±0.24	–0.28	±0.21	–1.65	±0.13
Davis	–	–	–0.70	±0.02	–2.25	±0.08

Station	α_s	$\pm\Delta\alpha_s$	α_t	$\pm\Delta\alpha_t$	α_q	$\pm\Delta\alpha_q$
Elaine	–1.17	±0.04	–1.37	±0.01	–1.54	±0.03
Emilia	–0.60	±0.05	–1.18	±0.04	–1.49	±0.03
Explorer	–0.18	±0.13	–0.42	±0.11	–3.75	±0.06
Faraday1h	–0.74	±0.06	–1.32	±0.07	–2.07	±0.19
Faraday3h	–0.73	±0.03	–0.97	±0.03	–1.63	±0.05
Ferrell	–0.87	±0.05	–1.13	±0.02	–1.64	±0.03
Fryxell	–0.55	±0.02	–0.87	±0.05	–3.00	±0.08
Gill	–1.00	±0.05	–1.38	±0.02	–1.42	±0.02
Glacier	–0.37	±0.16	–0.68	±0.06	–2.79	±0.05
Halley	–0.76	±0.15	–0.94	±0.09	–2.23	±0.06
Hoare	–0.46	±0.08	–0.57	±0.06	–2.64	±0.07
Laurie II	–0.94	±0.06	–0.72	±0.07	–2.91	±0.08
Lettau	–0.83	±0.03	–0.98	±0.03	–2.43	±0.03
Linda	–0.63	±0.03	–1.12	±0.02	–1.78	±0.02
Lorne	–0.58	±0.06	–1.01	±0.02	–2.13	±0.07
Marble Point	–1.02	±0.03	–0.91	±0.03	–1.89	±0.08
Mawson	–0.50	±0.05	–0.85	±0.03	–2.01	±0.07
McMurdo	–0.56	±0.02	–0.78	±0.04	–1.88	±0.10
Molodyozhnaya	–0.58	±0.07	–0.63	±0.10	–3.69	±0.07
Neumayer.10	–0.93	±0.06	–0.98	±0.04	–1.56	±0.02
Neumayer.1	–0.94	±0.26	–0.95	±0.04	–1.43	±0.09
Neumayer.2	–1.17	±0.18	–0.86	±0.04	–1.33	±0.07
Neumayer.3	–1.03	±0.10	–1.25	±0.06	–1.90	±0.04
Neumayer.4	–1.20	±0.18	–0.86	±0.09	–1.44	±0.05
Novolazarevskaya	–0.64	±0.06	–0.79	±0.04	–2.25	±0.06
Pegasus	–0.40	±0.06	–1.18	±0.04	–1.37	±0.04
Pegasus N	–0.58	±0.06	–1.31	±0.02	–1.96	±0.04
Pegasus S	–0.95	±0.03	–1.53	±0.01	–1.66	±0.02
Rita	–0.97	±0.03	–1.03	±0.02	–1.94	±0.05
Rothera	–1.23	±0.11	–0.74	±0.04	–3.01	±0.09
Scott Base	–0.51	±0.02	–1.31	±0.02	–1.03	±0.04
Schwerdtfeger	–0.75	±0.03	–1.27	±0.02	–1.6	±0.02
Willie Field	–0.50	±0.06	–1.06	±0.02	–2.31	±0.04

Volume II

Chapter 9

Food, Fuel and Depôts – An Antarctic Menu

Scott and his companions died on their return from the Pole, not from broken hearts over our earlier arrival, but from actual starvation, because of their inability to provide adequately for food on the return trip.

Roald Amundsen[1]

The causes of the disaster are not due to faulty organisation, but to misfortune in all risks which had to be undertaken.

Robert F. Scott[2]

Begin at the beginning
and go on till you come to the end:
then stop

Lewis Carroll[3]

In the preceding chapters, I relied on the *cæteris paribus* assumption that the weather was the only independent variable which influenced Captain Scott's *Terra Nova* Expedition. By making this assumption, I was able to concentrate my analysis on meteorological issues directly related to the expedition. More importantly, the weather was one of the few variables which no one was able to control or predict. In here, the reader may observe that I am admitting a tautology by saying that no one was able to predict the weather and that I, as shown in Chapter 7, was able to predict the weather during Captain Scott's marches. However, I was not predicting weather *per se* at One Ton Depôt. I was retrodicting the weather (minimum temperature) at One Ton Depôt in conjunction with the simultaneous daily weather at Cape Evans.

On many occasions, we have seen that the weather was not the only factor which influenced Captain Scott's expedition performance, but also low temperatures, powerful blizzards, friction, *etc*. In this context, a question arises of how the weather with its "random" fluctuations influenced Captain Scott's logistical plan for the journey to the South Pole.

Originally, I was not so much concerned with the logistics of Captain Scott's expedition, as it seemed like a straightforward logistical undertaking. However, the analysis of timetables of the First and Second Relief Parties (see section 2.3) prompted many doubts about their justification. More detailed calculations of the sledging velocities of Captain Scott and the First and Second Return Parties added

even more uncertainties to the actual execution of the 144-days plan to conquer the South Pole. Thus, the need to write about Captain Scott's logistics became more and more apparent.

In the current chapter, I will look in a more detailed way at the physical rather than epistemic uncertainties related to food, fuel and depôt distribution along Captain Scott's route to and from the South Pole. I will not analyze other requirements related to food and fuel. I will look at the issue from a logistical point of view.

9.1. The 144-Days Plan and Inward Journey

The first surprise comes when one tries to find what Captain Scott's *Southern Journey* plan was. Not just a general plan, but a detailed one including rations, distances and velocities. In vain one would rifle through Captain Scott's journals and/or historical accounts of his expedition. How is it possible that the fundamental issue of Captain Scott's *Terra Nova* Expedition or for that matter any Polar expedition was not described and analyzed? The authors of historical accounts were more interested in Captain Lawrence Oates' "prophecy" "Sir, I'm afraid you'll come to regret not taking my advice" – related to Captain Scott's decision of setting the One Ton Depôt at –79.4833[4] instead of –80.0 – than the actual numbers.

Captain Scott must have had a general plan of his expedition before the *Terra Nova* sailed from Cardiff, Wales, on June 15th, 1910. To execute this general plan he assembled his expedition, including means of transportation, food, and people.

Apparently, before going South in 1910, Captain Scott presented to the RGS a lecture in which he suggested that the *ideal* date to reach the Pole[5] would be Dec. 22nd. Since the account of the *Nimrod Expedition* was already published, Captain Scott could figure that if he would follow Lt Shackleton's route to the Pole, he would have to cross about $1345 + 97 \times 2 = 1539$ geographical miles in say $2 \times 52(30 + 22)$ days = 104 days,[6] starting on Nov. 1st. It would mean that the velocity of the travelling party must be 16.3 miles per day, *every day*, for 104 days! A staggering figure. No contingency plan. No delays, no blizzards and no rest. How Captain Scott was expecting to reach the Pole on such an early date without dog sledging transportation will remain a mystery.

It must have been part of a game for the participants of the *Heroic Age of Antarctic Exploration* to not disclose too many logistic details of their exploits. That alone was unscientific behavior. Traceability of their logistic records, measured by the ability to follow their journeys by going backward over the evidence step by step, is very limited. Captain Scott's fight to not permit Lt Shackleton to use the McMurdo Sound area for his *Nimrod Expedition* was arguably the most unscientific act he ever committed. On a similar note of reacting to British imperialistic dominance, Captain Amundsen responded[7]

> A number of people seem to be outraged by what we are doing down here – a breach of etiquette? Are these people mad? Is the Pole Scott's and Scott's alone? I don't care what these fools think.

Captain Scott was not shy in his account of his plans, or how he arrived at certain logistic figures[8]

> Monday, May 8 – Tuesday, May 9. [1911] As one of the series of lectures I gave an outline of my plans for next season on Monday evening. Everyone was interested naturally. I could not but hint [*sic*] that in my opinion the problem of reaching the Pole can best be solved by relying on the ponies and man haulage. With this sentiment the whole company appeared to be in sympathy. Everyone seems to distrust the dogs when it comes to glacier and summit. I have asked everyone to give thought to the problem, to freely discuss it, and bring suggestions to my notice. It's going to be a tough job; that is better realised the more one dives into it.

Captain Scott's above account is indeed confusing and shows how he was managing his crew. Was he really expecting that anyone will "bring suggestions" to his "notice"? However, since the depôts had been established and staffed with provisions in late January and February 1911, Captain Scott's *general* plan of the South Pole journey was set in motion.

On Sep. 10th, 1911, Captain Scott announced

> A whole week since the last entry in my diary. I feel very negligent of duty, but my whole time has been occupied in making detailed plans for the Southern journey. These are finished at last, I am glad to say; every figure has been checked by Bowers, who has been an enormous help to me. If the motors are successful, we shall have no difficulty in getting to the Glacier, and if they fail, we shall still get there with any ordinary degree of good fortune. To work three units of four men from that point onwards requires no small provision, but with the proper provision it should take a good deal to stop the attainment of our object.

However, in the meantime[9]

> Bowers gave us two of our best lectures, the first on the Evolution of Sledge Foods, at the end of which he discussed our own rations on the Depôt Journey, and made suggestions which he had worked out scientifically for those of the Polar Journey.

It appears that a detailed logistic plan concerning time, rations (food and fuel), distances, people and travelling means, was in place in early September 1911. One could only wonder what was so time-consuming for Captain Scott to figure out the Southern Journey rations and distances distribution along the route to the South Pole.

In terms of initial distribution of food and fuel rations, Captain Scott's plan of the *Southern Journey* was straightforward. It can be divided into two stages: the Barrier stage, and the beyond the Barrier (the Beardmore and Plateau) stage. This division was not only a geographical one. It was more importantly the division resulting from Captain Scott's overall mobility due to dog/pony/man sledging velocity, and the related potential possibility of food and fuel re-supplying party/depôts along the route at the Barrier stage. Once the parties started to ascend the Beardmore, they were beyond recall and on their own. From the foot of the Beardmore Glacier, the initial rations of food and fuel were only diminishing.

Captain Scott's plan was that three four-man sledge parties would ascend the Beardmore Glacier[10]

> The final advance to the Pole was, according to plan, to have been made by four men. We were organized in four-man units: our rations were made up for four men for a week: our tents held four men: our cookers held four mugs, four pannikins and four spoons.

Initially at the foot of the Beardmore, each man had to haul about 250 ℔ (113.4 kg). During the ascent of Beardmore, the parties (3) to reduce the weight of sledges set up depôts at the locations listed in Tab. 9.1. On Dec. 22nd, 1911, at a latitude of –85.3333 (the Upper Glacier (Mt. Darwin)), the First Return Party (Atkinson, Cherry-Garrard, Wright and Keohane) was sent back to Cape Evans. Years later, Cherry-Garrard commented[11]

> Before we left Scott at the top of the Beardmore he gave him [to Dr Atkinson] orders to take the two dog-teams South in the event of Meares having to return home, as seemed likely. This was not meant in any way to be a relief journey. Scott said that he was not relying upon the dogs; and that in view of the sledging in the following year, the dogs were not to be risked.

On Jan. 3rd, 1912, at latitude –87.53333, the Second Return Party (Lt Evans, Lashly and Crean) was sent back. Since Captain Scott was planning food and fuel rations all the way in units for four men, it was from this perspective that he made the surprising decision to take a five man party to the Pole. Surprising or not, this decision confirmed Captain Scott's confidence of reaching the Pole and safely returning. I will discuss this in Chapter 11.

It also, and most importantly, confirms that on Jan. 3rd, 1912, some 150 miles from the Pole, Captain Scott and Lt Bowers were stocked with food and fuel rations according to the original plan. It is another matter, as it was found later, that the required energy costs of sledging and sustaining human metabolism in Captain Scott's party were higher than they could get from their food rations.[12] It meant that although they consumed their planned daily food rations, the party was in want of food/calories.

It is important at this moment to notice that initially, only the Second Return Party reported a negligible small fuel leakage, and that food and/or fuel rations deposited at depôts along their route back to Cape Evans were sufficient. It appears that both the First and the Second Return Parties were excessively careful in taking their allotted portions of rations. For example Captain Evans commented[13]

> Here [Upper Glacier Depot under Mount Darwin] we took 3½ days' stores as arranged, and after sorting up and repacking the depôt had lunch and away down the Glacier

These comments also suggest that the First and Second Return Parties took exactly their share of food and fuel at the depôts. In summary, and despite the explorers' desire for additional food/fuel consumption, no food/fuel *shortages* and/or mismanagement *according to planned rations* was reported by:

- Captain Scott's Party until Feb. 7th, 1912,
- First Return Party from Dec. 22nd, 1911 until return to Hut Point/Cape Evans,
- Second Return Party from Jan. 3rd, 1912 until return to Hut Point/Cape Evans.

Table 9.1. A list of dates and times when depôts at certain locations were reached by Captain Scott's Party.

Time		Camp	Depôt Name	Location		Remarks
Date	Hour			Latitude	Longitude	
Dec. 21st	19:45	43	**Upper Glacier**	–85.1166	163.0800	First Return Party↑
Dec. 31st	6	52	Three Degree (3°)	–86.9333	161*	
Jan. 3rd	21:30	56	No Name Given	–87.5333	160.6833*	Second Return Party↑
Jan. 10th	13:45	62	1½ (1°½′) Degree	–88.4833	159.55	
Jan. 15th	14	66	Southern Depôt	–89.5333	160.35	
Jan. 17th	20	–	**1 Mile from S. P.**	–90	160*	South Pole
Jan. 18th	20:30	1	No Name Given	–89.8667	160*	
Jan. 20th	14:30	3	Southern Depôt	–89.5333	160.35	
Jan. 25th	15:30	7	1½ (1°½′) Degree	–88.4833	159.55	Captain Scott's journal entry "Half Degree Depôt" should read 1°½′ Depôt
Jan. 29th	–	–	No Name Given	–87.5333	160.6833*	Scott passed camp 56
Jan. 31st	–	–	Three Degree (3°)	–86.9333	161*	Scott passed camp 51
Feb. 7th	15	21	**Upper Glacier**	–85.1166	163.0800	
Feb. 13th	14	27	Middle Glacier	–84.2833	169.4167	
Feb. 18th	6	31	Lower Glacier	–83.6	171*	
Feb. 18th	3	32	Shambles Camp	–83.2000	174*	
Feb. 24th	–	37	Lower Barrier	–82.7833	172*	
Mar. 2nd	20	44	Middle Barrier	–81.5833	171*	
Mar. 9th	–	52	Upper Barrier	–80.5333	170*	
–	–	–	One Ton Depôt	–79.4833	170	

* Exact longitude of these depôts is not known.

One more time, I will recall that the distribution (placement) of depôts was done in accordance to the planned 144-days journey from Hut Point to the South Pole and back.

Captain Scott has been frequently criticized for finely (no contingency) cutting the amount of food/fuel at depôts along his route. However, these critical opinions are indeed uneducated. Obviously anyone, including Captain Scott, would like to have

a great surplus of food/fuel at each depôt, occasionally accompanied with a bottle of *Dom Pérignon*.

However, if one remembers that the amount of food/fuel stored at each depôt was a derivative of sledging velocity, which by itself is a complex variable, one would appreciate Captain Scott's contingency plan. The contingency plan was not in the food/fuel surplus at each depôt but rather by assuming a *low velocity* (10.1 miles/day) of sledging during the Southern Journey.

If the depôts were placed at regular distance intervals calculated under the assumption of low sledging velocity (10.1 miles/day for 144-days), then by increasing the actual sledging velocity Captain Scott's party would have had a surplus of food/fuel. By saying that, I am speaking in terms of *average* sledging velocity for the whole 144-days journey. From this perspective, temporary setbacks in keeping minimum sledging velocity due to various factors would only briefly diminish overall performance.

I presume that the above observation would come as a revelation even to Captain Scott's hagiographers. However, if one consults my figures depicting Captain Scott's and the supporting parties' average velocities (Figs. 2.3 and 4.11), then Captain Scott's contingency plan is rather palpable.

9.2. Outward Journey

It was a blow to Captain Scott and his party to arrive second at the South Pole. The usually witty and plausible entries in Captain Scott's journal become disarrayed, beginning with the one written in the evening entry of Tuesday, Jan. 16th, 1912. Intertwined sentences rather erratically describing personal feelings and facts related to their journey are suddenly present. The outward journey, right from its beginning, was very different than the inward journey to the South Pole.

Until Jan. 16th, 1912, Captain Scott was an RN officer performing his act of duty. From time to time he sent mixed messages, but otherwise he was always defiant. It wasn't until Bowers "detected a black speck ahead" which resolved itself into a black flag and "told us the whole story" that his messages changed in tone. From that point on, Captain Scott vividly observed

> none of us having slept much after the shock of our discovery
>
> The Pole. Yes, but under very different circumstances from those expected. We have had a horrible day …
>
> Great God! This is an awful place and terrible enough for us to have laboured to it without the reward of priority.
>
> It is a terrible disappointment, and I am very sorry for my loyal companions. Many thoughts come and much discussion have we had. To-morrow we must march on to the Pole and then hasten home with all the speed we can compass.

Indeed, it was certain that they must sledge homeward "with all the speed" they could achieve. Up to arriving at the South Pole, the party travelled with velocities equal to or much higher (see Figs. 2.3 and 4.12) than originally assumed in the origi-

nal 144-days journey plan. However just before departing from the Pole, Captain Scott uncritically remembered his earlier comment, presented during a speech to the RGS in 1910, to state

> I fancy the Norwegians arrived at the pole on the 15th Dec. and left on the 17th, ahead of a date quoted by me in London as ideal, viz. 22 Dec.

If Captain Scott or anyone wanted to arrive at the South Pole on Dec. 22nd, he must give an answer as to his method of transportation. We know Captain Amundsen's right answer. We also know Captain Scott's multi-velocity transportation means. His party(s) velocity *could not* be faster than the velocity of its slowest elements – ponies and humans. How Captain Scott could have arrived at the Pole on or about Dec. 22nd will remain unanswered.

The above is described to show that Captain Scott was constantly aware of his party's velocity standing. Actually, he constantly monitored his party's progress "If we can keep up the pace, we gain on Shackleton, and I don't see any reason why we shouldn't, except that more pressure is showing up ahead."[14]

In Chapter 2, on Fig. 2.3 in conjunction with the Cherry-Garrard phony First Relief journey, I presented the respective plots of mean velocities of Captain Scott and the return parties. This figure as well as Fig. 4.11, comparing Captain Scott's and Lt Shackleton's velocities, are telling. In particular, despite some drawbacks during the outward journey, Captain Scott was able to maintain steady progress. At the Barrier stage, he continued his journey with a velocity of about $\upsilon \approx 10.9$ m/d (geographical miles/day), and during the stage up the Beardmore Glacier and Antarctic Plateau, with a velocity of about $\upsilon \approx 10.8$ m/d.

Before Captain Scott reached the South Pole, two so-called Return Parties were detached from the main party. The First Return Party (Atkinson, Wright, Cherry-Garrard, and Keohane) on December 21st, 1911 returned from the Upper Glacier Depôt. Their velocity, including the Beardmore Glacier stage, was $\upsilon \approx 13$ m/d.

The Second Return Party (Lt Evans, Lashly, and Crean) was ordered to turn back on Jan. 3rd, 1912, some 150 miles from the Pole. On their return over the Plateau and down the Beardmore stage, they travelled with a fine velocity of $\upsilon \approx 13.5$ m/d and over the Barrier with $\upsilon \approx 13.2$ m/d.

Comparing the velocity of the Second Return Party ($\upsilon \approx 13.5$ m/d), Captain Scott's inward ($\upsilon \approx 14.3$ and 10.8 m/d) and outward ($\upsilon \approx 14.3$ m/d) at the Plateau stage, one would say that these velocities were parallel. However, by looking at Captain Scott's velocity of descending the Beardmore Glacier $\upsilon \approx 9.6$ m/d in comparison with the velocity of the First and Second Return Parties over the same route $\upsilon \approx 13$ m/d and $\upsilon \approx 13.5$ m/d, respectively, one immediately wonders why a 30% reduction of velocity occurred.

These are only dry numbers. However, if one consults Captain Scott's journal in the hope of finding an explanation and/or comment by Captain Scott discussing the issue of the sledging velocity being significantly slower than expected, one would find nothing.

However, the investigative reader can find a few entries in Captain Scott's journal which hint at why the sledging velocity was so low. Indeed, occasionally he wrote[15]

> The surface was awful, the soft recently fallen snow clogging the ski and runners at every step, the sledge groaning, the sky overcast, and the land hazy.

But then, wasn't the surface "awful" from time to time when the party was sledging up the Beardmore or Plateau? Of course it was, as for example on Feb. 11th, the surface was "wretched" and on February 1st, the surface was "real bad", *etc*. However, during these examples the party was able to achieve more than a fair velocity, on average.

Why was the party able to sledge up the Beardmore with $\upsilon \approx 13$ m/d, but descend from it on the same route with a velocity of only $\upsilon \approx 9$ m/d? During the Beardmore Glacier descent, Captain Scott at no instance made a comment and/or observation on their slow progress and steady fall behind the planned schedule.

Only once, at the end of the Beardmore stage and in the most unfortunate moment, did Captain Scott call on the importance to move forward. While descending the Beardmore, P. O. Evans was getting increasingly ill and unable to follow the party. Even though in the morning of Feb. 17th, P. O. Evans "looked [to Captain Scott] a little better after a good sleep" his condition after the marching was resumed started to rapidly deteriorate, and he just trailed behind the sledge. Instead of caring for the incapacitated Evans, Captain Scott found a sudden urge and commented, "We had to push on, and the remainder of us were forced to pull very hard, sweating heavily".

We do not know for how long the party was pulling very hard, but

> Abreast the Monument Rock we stopped, and seeing Evans a long way astern, I camped for lunch. There was no alarm at first [*sic*], and we prepared tea and our own meal, consuming the latter. After lunch [*sic*], and Evans still not appearing [*sic*], we looked out, to see him still afar off. By this time [*sic*] we were alarmed
>
> … I was first to reach the poor man and shocked at his appearance; he was on his knees with clothing disarranged, hands uncovered and frostbitten, and a wild look in his eyes.

In the evening of the same day, Feb. 17th, 1912, P. O. Edgar Evans died. Captain Scott's description is one sided. What did P. O. Evans think when he saw his comrades slowly but steadily disappearing at the foot of the Beardmore Glacier? Did he feel abandoned? Was the party signaling to him that his state was a hindrance to the party? Was P. O. Evans a "poor man," or a fellow explorer left by comrades to perish? Anyone left alone by sledging comrades without food and shelter at the Barrier would quickly have "a wild look in his eyes". On that day, a recorded temperature of 0.7°F to 3.3°F[16] would lead to frostbite of unprotected skin in about 30 minutes.

We know from previous chapters that Captain Scott had a logistical plan on how to reach and return from the South Pole. The essence of this plan was to undertake a 144-days trip from Hut Point by various means of transportation supported by a number of food depôts along the route. Captain Scott, long before his actual departure would "have been digging away at food statistics"[17]. Since here I am only interested in food ration distribution during the Antarctic Plateau and return trip, I will not discuss in this chapter the overall ration organization during his expedition.

Captain Scott (and Lt Bowers) in his calculations used an X.S. unit of food, which meant "a week's supplies for four men".[18] A week of sledging according to original plan meant 7×10.1 miles/day ≈ 71 miles.

On Dec. 20th, 1911, Captain Scott, while approaching what was called the Upper Glacier Depôt (Mt. Darwin), commented in his journal

> I calculated our programme to start from 85°10′ with 12 units of food and eight men. We ought to be in this position tomorrow night, less one day's food.

Two weeks later, on Jan. 3rd, 1912, at the location of –87.5333, 160.6667, and when it was announced that Teddy Evans, Lashly, and Crean would return to Cape Evans, Captain Scott described his plan

> We have 5½ units of food – practically over a month's allowance for five people – it ought to see us through.

Indeed, since they were 149 miles from the Pole, they would travel to the Pole in about 14¾ days at a velocity of 10.1 miles per day, as assumed in the original 144-days plan. Since a party of 5 men needed 1.25 food units per week, Captain Scott's 5½ units were exactly the right amount of food for over one month of sledging. In addition to the food, the party also carried fuel. I assume that the amount was roughly proportional to the carried food rations. After returning from the Pole, the party was re-supplying at food and fuel depôts along the return route.

What is important to notice from the above is that Captain Scott was indeed within his and Lt Bowers' calculations, using the 144-days plan value of sledging velocity ($\upsilon \approx 10.1$ miles/day).

Captain Scott has been criticized for his lack of contingency plans. However, these critics were not analytically minded and provided only empty-handed condemnation. Let me repeat that Captain Scott's contingency plan was his initial assumption of a sledging velocity about $\upsilon \approx 10.1$ miles/day.

In Chapters 2 and 4, by looking at the sledging velocities of the various parties, I have observed that for prolonged times, despite some temporary setbacks, sledging velocities remained steady for long periods of time. Presenting their figures of travelled distance *vs.* sledging time served their specific purpose. Here for better understanding and visualization, I will recast these figures in terms of the *progress* of sledging *vs.* the assumed 144-days schedule. This will show how Captain Scott's contingency plan was working.

Since Captain Scott and Lt Bowers were calculating depôt and sledging allowances according to the 144-days schedule, the deviations will indicate deficiency or surplus of food/fuel supplies. Fig. 9.1 illustrates this. Just by looking at the fraction of days behind the 144-days schedule, one could make many interesting observations related to their performance.

From the moment the party left the South Pole, the party was gaining on the schedule with each passing day. On day 84 (from Nov. 3rd), Jan. 25th, 1912, the party sledged across the Antarctic Plateau *right* on the 144-days schedule.

On Fig. 9.1, if the curve is below the black solid line representing the schedule line, it means that that party was lagging behind the expected (assumed) timetable. Therefore, for a good part of the inward journey the party(s) was indeed behind the plan, and only briefly between Nov. 25th through to Dec. 4th, 1911 was the Captain Scott party ahead of schedule. One with knowledge of the Southern Journey events, and just by looking only at the black dots indicating the time of reaching various

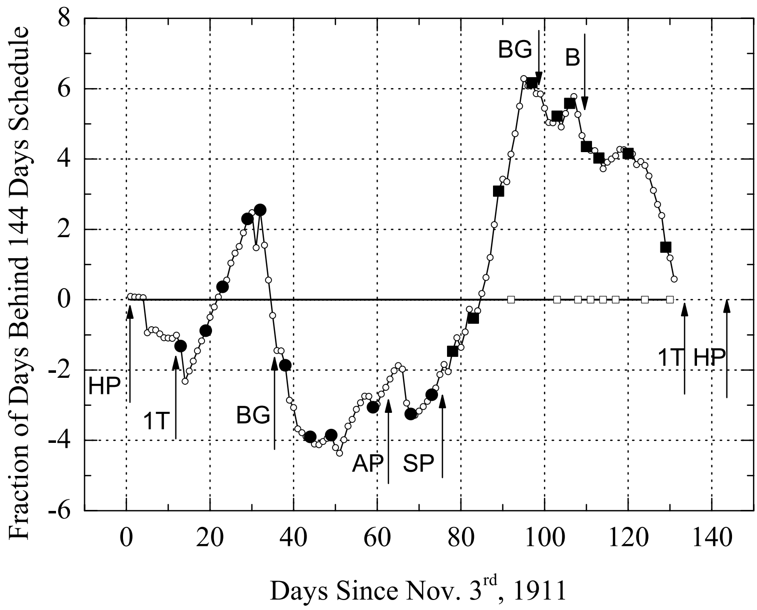


Figure 9.1. Progress measured by the fraction of days behind the 144-days schedule of the main (Captain Scott) party since Nov. 3rd, 1911. The following abbreviations have been used: HP (Hut Point), 1T (One Ton Depôt), BG (Beardmore Glacier), AP (Antarctic Plateau), SP (South Pole) and B (Barrier). In order to find the time during which the Captain Scott party was behind or ahead of the schedule, one could perform an integration of the respective areas above and under the actual field data. In relative units (digitally calculated using Wolfram Mathematica® Software) the respective areas from left to right are: –19.2, +17.4, –131.9 and +186.5, respectively. Since the party was moving during 131 days, a simple calculation indicates that for 43% and 57% of days the party was slower or faster than the 144-days schedule, respectively. Captain Scott's depôts reached on inward and outward journeys are indicated by • and ▪, respectively. Hollow squares □ on 144-days line indicate respective depôts scheduled according to Captain Scott's original theoretical (initial) plan. The list of depôts is given in Table 9.1.

depôts, can make many educated guesses and correlate these moments. I will not venture to make such a description and provide a factual correlation here.

For historical insight, it is far more important to point out that despite the fact that for most of the inward journey the party(s) was well behind the planned timetable, neither Captain Scott or any of his companions were making comments of food/fuel shortages. Not one word. However, since entering the Beardmore Glacier, the parties were dragging *all* food/fuel supplies with them for the remaining inward and outward journeys, the question arises as to which food/fuel provisions they used?

The point is that if the food/fuel rations were calculated for the 144-days schedule, the party sledging behind the timetable will need to consume more rations than the available rations. In the opposite case, say that on the way back, the party somehow glided down the Beardmore in say one instead of ten days then the party would have a surplus of food/fuel provisions, something close to the entire amount of rations depôted on the glacier.

Returning to Fig. 9.1 and the ascent of the Beardmore, one can see that for a good time the party was 3 to 4 days behind schedule. It means that the party was consuming more food/fuel rations than expected (planned). That would mean that the party would at a certain moment consume its allocated rations and would be forced like Lt Shackleton to prematurely return. Since Captain Scott did not comment on this apparent food/fuel shortage, one may assume that he:

- just did not comment,
- had extra (more than the planned) rations,
- did not want to comment.

The answer, or at least partial answer, was given by Captain Scott himself on December 20th, 1911 when he commented

> I calculated our programme to start from 85°10′[Upper Glacier (Mt. Darwin)] with 12 units of food and eight men.

The above comment suggests that somehow despite lagging behind the schedule during the Beardmore ascent, the party was not short of food/fuel rations and more importantly did not expect to be.

But then, I wondered about the importance of Captain Scott's remark in his Message to [the] Public

> 2. The weather throughout the outward journey, and especially the long gale in 83°S., stopped us.

How could a mere four days at the foot of the Beardmore Glacier significantly influence Captain Scott's overall performance during the Southern Journey? My naïve thinking was telling me that Captain Scott in his *Message to the Public* was just cataloguing his mishaps due to "risks which had to be undertaken." Indeed, he did not explain how the blizzard in 83°S. changed the expedition. Before explaining the importance of these 4 days, let me return to the analysis of food/fuel rations after Captain Scott's arrival at the Upper Glacier Depôt.

The summary of dates, times, depôt names, and locations is collected in Table 9.1. Now, I will analyze this table in conjunction with Fig. 9.1 and the food/fuel rations available to Captain Scott and his comrades.

Let me *repeat* that after taking off from the foot of the Beardmore Glacier, the Captain Scott party(s) was on its own, beyond external control and the possibility of re-supplying. Additionally, the party was sledging the 144-days timetable regime. This regime was determining the daily sledging distances and food/fuel distribution at depôts along the route.

Upon arriving at the location which was called Upper Glacier (Mt. Darwin) in the evening of Dec. 21st, 1911, the Captain Scott party established the respective 144-days schedule depôt. It was decided that the First Return Party would return to Cape Evans the next day, while the party of eight men including Captain Scott would proceed forward. The day before Captain Scott clearly indicated that this party would sledge toward the South Pole, he wrote

> We ought to be in this position tomorrow night, less one day's food. After all our harassing trouble one cannot but be satisfied with such a prospect.

Therefore, the First Return Party and the Captain Scott party departed in opposite directions carrying 2 and 11.86 units of food/fuel rations, respectively.

The Captain Scott party progressed, and after two (2) weeks on Jan. 3rd, 1912 at Camp number 56, Captain Scott ordered the Second Return Party to return to Cape Evans. Since one (1) unit was allocated for the four men and one week of sledging on Jan. 3rd, Captain Scott would have had at his disposal 7.86 units.

On this day, Captain Scott described in his journal

> Within 150 miles of our goal. Last night I decided to reorganise, and this morning told off Teddy Evans, Lashly, and Crean to return. They are disappointed, but take it well. Bowers is to come into our tent, and we proceed as a five man unit to-morrow. We have 5½ units of food – practically over a month's allowance for five people – it ought to see us through. We came along well on ski to-day, but the foot-haulers were slow, and so we only got a trifle over 12 miles (geo.). Very anxious to see how we shall manage to-morrow; if we can march well with the full load we shall be practically safe, I take it [*sic*].

It is popular wisdom about Captain Scott to say that by taking the Fifth Man, he created an unnecessary time-consuming hindrance for the party to split food/fuel rations for three and five men's daily allowances. One can disprove such a notion; in Chapter 11, I will do just that.

Something else, and indeed life-threatening, occurred to the whole party on Jan. 3rd, 1912. It was Captain Scott's decision to attempt to sledge to and back from the South Pole. Because of this, each day meant that Captain Scott's push towards the Pole was threatening his and his companion's lives more and more.

We know from the history of Lt Shackleton's *Southern Journey* that exactly three years before Captain Scott, on Jan. 4th, 1909, he finally had to admit defeat. Lt Shackleton's party was short of food and on Jan. 9th and after reaching 88°23′S (–88.3833), the party turned back.

Did Captain Scott, on Jan. 3rd, 1912, have sufficient food/fuel rations to reach and return from the South Pole?

Let me re-cap that on this day, he had at his disposal 7.86 units. The Second Return Party (3 men) needed, according to the 144-days plan, 1.5 units to return to the Upper Glacier depôt. Thus, Captain Scott was left with 7.86–1.5 = 6.36 units. Since he took with him 5.5 units to get to the Pole and return, the 0.86 unit was stored at the location which I call No Name Depôt on Jan. 3rd, 1912 (see Tab. 9.1).

On this day, Captain Scott could calculate the theoretical distance from No Name Depôt to the South Pole to be 149 miles. If the party was sledging according to the 144-days schedule, then it would mean they would arrive at the Pole in 149/10.1 = 14.7 days. Since the 5 man party needed 0.18 units per day, it meant that the party needed about 2.65 units to get to the Pole and an additional 2.65 units to return to No Name Depôt, totaling 5.3 units. Since Captain Scott had 5.5 units at his disposal, he would return to No Name Depôt with a 0.2 unit (one day) surplus.

Finally, after the round trip, his party would have 0.2 + 0.86 = 1.06 units of food/fuel at No Name Depôt to be used to sledge 146.2 miles in the ski-prints of the Second Return Party to the Upper Glacier Depôt. The initial 1.06 units translated into 5.7 days of sledging food rations. However, since we know from Dr Wilson's journal that[19]

> January 31: Again walking by the sledge with swollen leg but not nearly so painful. We had 5.8 miles to go to reach our Three Degree Depot [3°]. Picked this up with a week's provision and a line from Evans, and then for lunch an extra biscuit each, making 4 for lunch and 1/10 whack of butter extra as well.

one can easily calculate that the Captain Scott party would have had 5.7 + 7 = 12.7 days of food/fuel rations to be used to sledge 146.2 miles. While staying within the 144-days schedule, the Captain Scott party would travel about 14.5 days.

Comparing the required food/fuel rations of about 14.5 days with the actual 12.7 days of rations at his disposal, the conclusion is palpable. The party would starve with *no* food/fuel for roughly two (2) days. I cannot prove it, but I think it is sensible to say that if the Captain Scott party was exposed for 2 days/nights without food/fuel at the Antarctic Plateau, they would have certainly perished. Indeed, a suicidal mission.

The above simple calculations are based on Captain Scott's data collected during his march *until* Jan. 3rd, 1912, and should have told him to return, or at least dash as far south as possible and return from the location closer to the Pole than was achieved three years before by the Lt Shackleton party.

None of that happened. Then what was Captain Scott's plan? What was his rationale to push to the Pole? Indeed, nothing can be found in his journal. No justification, no argument and no analysis. It is startling to read one more time Captain Scott's comment on Jan. 3rd that 5½ units "ought to see us through". It is true, but he did not answer the problem of how to return to the Upper Glacier Depôt, on 12.7 instead of 14.5 summit sledging rations of food/fuel.

I think that on Jan. 3rd, 1912, Captain Scott crossed the Rubicon in committing himself and his comrades to reach the South Pole at all costs, even at the risk of perishing during the final inward/outward miles, and especially before reaching the Upper Glacier Depôt with 7 days food/fuel supplies. Evidently, they were short of at least two days food/fuel rations. Since the round journey would take about a month, Captain Scott would have thought about a contingency plan by adding possible weather related delays. A one-day delay due to "our first summit blizzard" happened on Jan. 8th. In the above context, it now seemingly appears evident why Captain Scott mentioned (listed) the 4 days blizzard in his *Message to the Public*.

Teddy Evans gave us an insight into that crossing of the Rubicon. In March 1930, the by then Rear-Admiral Evans gave a lecture on the *Terra Nova Expedition* to the Royal Society. Alongside his factual slip-up/the newspaper's misquote in saying that the men were 1168 miles away from Cape Evans when the Second Return Party began its return, Evans confirmed that Captain Scott had full logistic awareness[20]

> On January 3, 1912, Scott consulted with the lecturer [Evans –KS], declaring his confidence in reaching the Pole, but stating his misgiving as to whether he would come safely out again. He asked that the final supporting party [Admiral Evans's] [*sic*] should attempt to make its own way back one man short, and the decision was arrived at, Scott thereby gaining an extra man.

While thinking about Captain Scott's possible intention, one could suggest that he could choose to go on half rations. Even then, and without *post factum* knowledge that even full rations (summit ration) were insufficient to account for party energy expenditure, I think without being able to prove it, that the party would perish.

It appears that Captain Scott selected another dangerous method to reach and return from the Pole. The method was to increase the sledging velocity to above 10.1 miles/day (the velocity mandated by the 144-days schedule), and thus *shorten* the time needed to reach the Upper Glacier Depôt food/fuel cache. Figure 9.2 illustrates the daily sledging velocity of the Captain Scott party before and after attaining the Pole. On the same figure, I also depicted the party's *average* sledging velocity calculated for two periods of time: before and after attaining the South Pole. These average sledging velocities are 10.8 miles/day and 14.3 miles/day, respectively. One has to understand these averaged velocities as sustained velocities over a considerable time period. That means that despite some temporary velocity fluctuations, the party was sledging at about the calculated velocities.

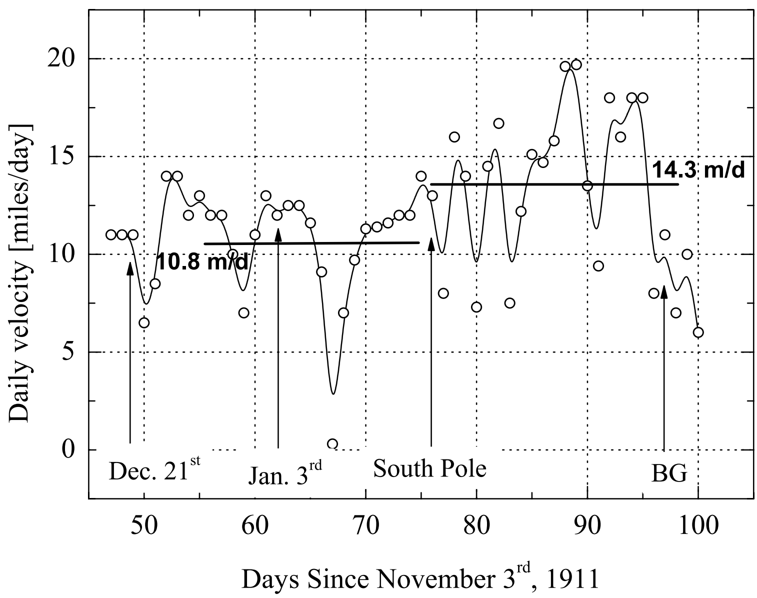


Figure 9.2. The average daily sledging velocity of the Captain Scott party: before at 10.8 miles/day (———), and after at 14.3 miles/day (———) reaching the South Pole. The actual velocities reported by the party are depicted by ○ and the solid black line connecting these points is the B-spline.

It is important to notice the sudden jump of average velocity right after the party reached the South Pole. Indeed, it represents about a 32% increase. The investigative reader can also notice from this figure that a couple of days before reaching the Pole, the Captain Scott party was steadily gaining daily sledging velocity.

Even after reaching the Pole, and contrary to Captain Amundsen's party[21]

> Bjaaland astonished me at dinner that day. Speeches had not hitherto been a feature of this journey, but now Bjaaland evidently thought the time had come, and surprised us all with a really fine oration. My amazement reached its culmination when, at the conclusion of his speech, he produced a cigar-case full of cigars and offered it round. A cigar at the Pole! What do you say to that? But it did not end there.

The Captain Scott party began its return faster, and with no ceremony.

In a more detailed way, the essence of Captain Scott's sledging marches over the Plateau is carefully depicted on Fig. 9.3. On this figure, Captain Scott's party 'fraction of days' behind the 144-days schedule is shown, along with the scheduled rate of progress. On the same figure, I also depicted solid dots (•) the respective depôts reached and to be reached by the party. These points (depôts) are connected by dotted black gradient lines, indicating the time (in days) difference (delay) in reaching respective depôts.

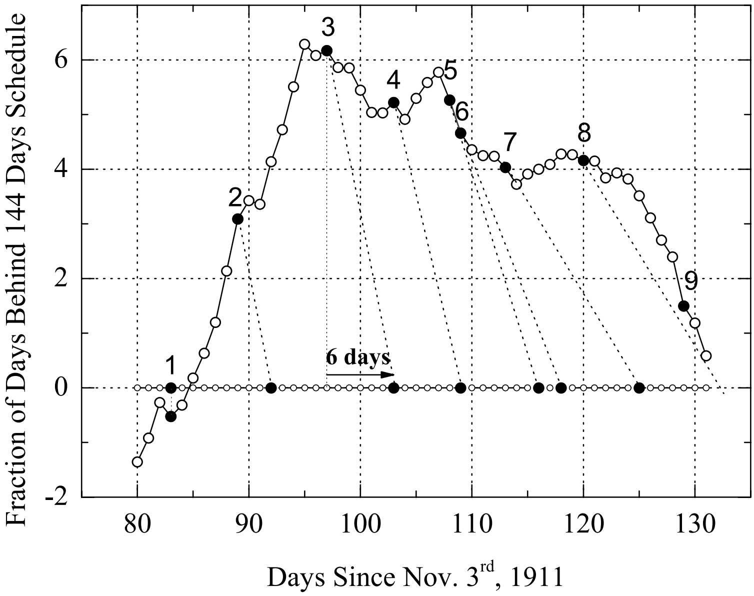


Figure 9.3. The Captain Scott party's fraction of days (○) behind/ahead of the 144-days planned schedule (○). Planned and actual depôts reached by the party are indicated by (•) and numbered from 1 to 9. The names of respective depôts are: 1–1½ (1°½′) Degree, 2-Three Degree (3°), 3-Upper Glacier, 4-Middle Glacier, 5-Lower Glacier, 6-Shambles Camp, 7-Lower Barrier, 8-Middle Barrier, and 9-Upper Barrier/Mount Hooper, respectively. The gradient dotted black lines connect the same depôts reached with when they were supposed to be reached by the Party. The Upper Glacier Depôt (3) was reached by Captain Scott's party about six days ahead of original schedule, as indicated on the figure.

Let us look at the most crucial moment of the Captain Scott party's return from the Pole, that is between 1½ (1°½′) Degrees and the Upper Glacier Depôts, indicated on Fig. 9.3 by numbers 1 and 3, respectively. The distance between these two depôts is about 146 miles, and according to the initial (original) schedule it should be traversed in about 14.5 days (= 146 [miles]/10.1 [miles/day]). If the Captain Scott party was travelling according to this schedule, it would have been short by at least two days of food/fuel to reach the Upper Glacier Depôt. I think that the party was aware of food/fuel deficiency at this crucial stage of the journey, and for that reason it sledged at a much higher velocity, as depicted on Fig. 9.2. Thus, the party reached the Upper Glacier Depôt on the 97th day of the journey, Feb. 7th, 1912 instead of the planned Feb. 13th. That alone saved the party from starvation and possible death.

However, to what extent was the shortage of food/fuel on the return from the Pole – the 1½ (1°½′) Degree – Upper Glacier stage–forcing the Captain Scott party to sledge at a rate 32% more than initially assumed? By its nature, it is a complex question.

However, returning to Fig. 9.3 and looking at Captain Scott's fraction of days ahead of schedule beyond the Upper Glacier Depôt (depôt number 3), one can see that almost to the very end of their journey, in March 1912, the Party was with varying degrees ahead of schedule.

All depôts after the Upper Glacier Depôt were spaced out at distances of about seven (7) days rations. However, because the Captain Scott party was accelerating relative to the 144-days schedule, the party surely collected food/fuel rations more frequently than once every seven days. Accordingly, as one can find from Fig. 9.3, the party after reaching the Upper Glacier depôt collected food/fuel at intervals: 6, 5, 4 and 7 days respectively. These figures clearly tell us that Captain Scott and his party should not have suffered any shortage of food/fuel, at least during the Upper Glacier – One Ton Depôt stage.

In addition, one would also observe that at Shambles Camp, the Captain Scott party collected or could collect as much as they could carry in pony meat. These unplanned food rations not only provided extra energy but also, though in a limited way, vitamin C to the party rations.

Finally, since additional food/fuel rations were allocated to the 5 man party, and Petty Officer Edgar Evans and Captain Lawrence E. G. Oates perished on Feb. 17th and Mar. 16th, 1912 respectively, their rations were free to be used by the remaining party members.

The argument is indeed very simple. To make the round journey from Hut Point to the South Pole and back to One Ton Depôt, Captain Scott must travel about 1318 miles (geographical). Since Captain Scott was executing his 144-days plan (Hut Point to – the South Pole – back to Hut Point), he meant to sledge 1498 miles. Thus, the sledging velocity must be 10.1 miles/day. The depôts had been laid down with food/fuel rations according to this plan. Therefore, while sledging on *full* rations, Captain Scott should arrive at One Ton Depôt after exactly 130.5 days. In reality, the Captain Scott party approached within 51 miles of One Ton Depôt on Mar. 12th, 1912 after 131 days of sledging. This is precisely what is graphically depicted on Fig. 9.2.

In summary, the expected surplus of food/fuel rations of the Captain Scott party during the return Barrier stage and before One Ton Depôt was due to:

- higher than planned sledging velocity,
- pony meat at Shambles Camp,
- rations not used by Evans and Oates.

Why then, from all the depôts, only those located at the Barrier suffered from fuel shortage? On Feb. 24th, after reaching the Lower Barrier Depôt and three days before the *Extreme Cold Snap* was invented by Captain Scott, (see Chapter 7), he recorded

> Saw depôt and reached it middle forenoon. Found store in order except shortage oil[26] [26 stands for the end note added to Captain Scott volume by Leonard Huxley – KS] – shall have to be very saving with fuel – otherwise have ten full days' provision from tonight

This particular description is difficult to understand by the investigative reader. The first objection is directly related to the unscientific account of oil (fuel) shortage. In the above as well as in the following accounts, including the *Message to the Public* – "a shortage of fuel in our depots for which I cannot account" – Captain Scott is not giving any numbers as for volume (weight) of missing oil (fuel). That alone prohibits further investigation and scrutiny. However, it was not only Captain Scott who noticed a shortage of oil. On Jan. 30th, 1912, William Lashly, a member of the Second Return Party observed in his diary[22]

> … after taking our food we found a shortage of oil and have taken what we think will take us to the next depot. There seems to have been some leakage in the one can, but how we could not account for that we have left a note telling Capt. Scott how we found it, but they will have sufficient to carry them on to the next depot, but we all know the amount of oil allowed on the Journey is enough, but if any waste takes place it means extra precautions in the handling of it.

Yet again, Lashly's comment, like Captain Scott's description above, is not precise and leaves room for speculation. One may excuse Chief Stoker Lashly. However, it is difficult to excuse his supervisor Lt Evans[23] for not giving an approximate volume shortage of "as it turned out [to be]" the most crucial item supporting the Captain Scott party.

However, one may argue on the contrary. Since the leakage was insignificant and negligible, either Lashly or Lt Evans did not think it was particularly important or technically possible to assess the leaked volume of oil (fuel). Lashly's description seems to support the conclusion that the oil leakage was small and insignificant.

On Fig. 9.4, I also depicted the fraction of days behind/ahead of the 144-days schedule for the First and Second Return Parties, along with the Captain Scott party's data. Despite certain specific features, changes of the fraction of days behind/ahead the 144-days schedule for both parties (First and Second) in the beginning show similar behavior to Captain Scott's party. From the initial lag behind the schedule, both parties advanced rapidly and gained distance and time relative to the 144-days timetable. Only in the period of Jan. 15th through to the 21st did the Second Return Party experience sledging difficulties. Accelerating relative to the 144-days schedule meant that both the First and Second Return Parties would pass through the depôts sooner than expected, and thus have more food/fuel rations, as it was in the case of Captain Scott. Both parties, on the contrary to Captain Scott, did not report an important (significant) shortage of food/fuel rations at the depôts.

Since the leakage of oil tins was recognized by "independent" parties, one has to take it for granted as a usual phenomenon related to the physical properties of materials used in tin construction, but also the method of tin storage. Captain Scott was frequently criticized by various authors because the leakage of tins was known since his *Discovery Expedition*, and he did not take appropriate steps to ensure that a similar leakage would not take place during his *Terra Nova Expedition*. In his own *Discovery Expedition* account, he noticed a wide array of issues[24]

> Each tin had a small cork bung, which was a decided weakness; paraffin creeps in the most annoying manner, and a good deal of oil was wasted in

this way, especially when the sledges were travelling over rough ground and were shaken or, as frequently happened, capsized. It was impossible to make these bungs quite tight, however closely they were jammed down, so that in spite of a trifling extra weight a much better fitting would have been a metallic screwed bung. To find on opening a fresh tin of oil that it was only three parts full was very distressing, and of course meant that the cooker had to be used with still greater care.

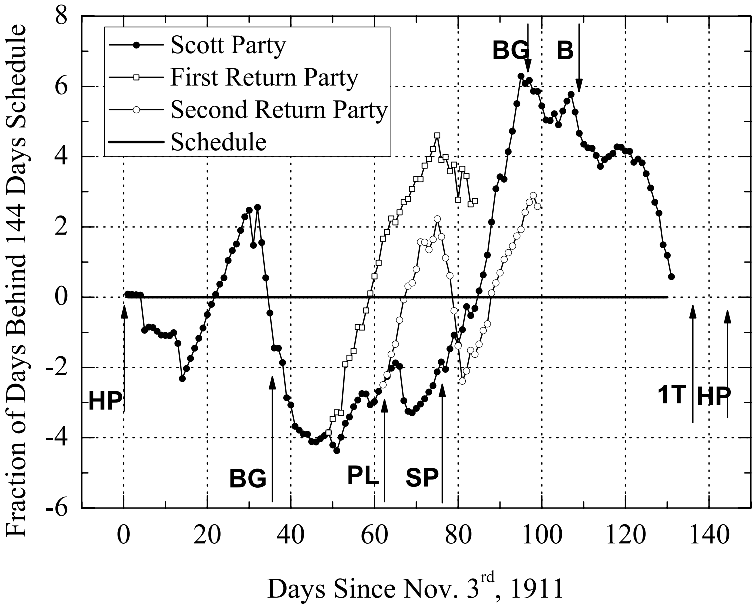


Figure 9.4. Captain Scott (•), First (□) and Second (○) Return Parties' fraction of days behind/ahead of the 144-days planned schedule. The following abbreviations have been used: HP (Hut Point), BG (Beardmore Glacier), PL (Antarctic Plateau), SP (South Pole), B (Barrier) and 1T (One Ton Depôt).

Captain Scott mentions that "a good deal of oil was wasted" during transportation over rough surfaces. This particular explanation is indeed surprising if one recalls that *all* oil tins were transported over great distances. Therefore, and according to Captain Scott's observations during the *Discovery Expedition*, the tins transported over ever increasing distances should have less and less oil. Thus the further the tins were transported, the less oil a tin must contain. Consequently, Captain Scott should have observed the shortage of oil (fuel) during the Plateau journey, to a lesser extent at the Beardmore, and in a much lesser degree, if at all, at the Barrier stage.

None of that was observed and reported by Captain Scott, or the First or the Second Return Parties. There was no tin leakage reported at the Antarctic Plateau, or during the Beardmore Glacier journey, but only during the return stage at the Barrier. Additionally, the serious leakage of oil tins was not observed/reported by many parties sledging over the Barrier during many various journeys.

The above observation runs strongly counter to Captain Scott's observations and descriptions during the *Discovery Expedition* cited above. One may argue, that since the oil leakage was not related to the distance over which the tins were transported by sledge, it could be related to the time at which the tins were exposed to elements. Certainly, the tins stored at the Barrier to be used during the return of the Captain Scott party were exposed for the longest time; say about four months – from mid-November 1911 until mid-March 1912.

The answer of how storage time influenced the possible oil leakage from tins comes, surprisingly, from Cherry-Garrard's account, as a result of Dr Atkinson's description of the *Terra Nova Expedition* where he accounts[25]

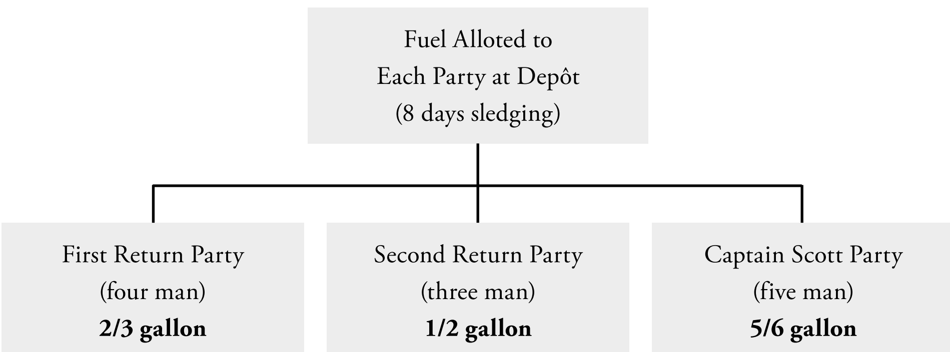
> We then found the Polar Party and learned of the shortage of oil. After our return to Cape Evans someone was digging about the camp and came across a wooden case containing eight one-gallon tins of paraffin. These had been placed there in September 1911, to be landed at Cape Crozier by the *Terra Nova* when she came down. The ship could not take them: they were snowed up during the winter, lost and forgotten, until dug up fifteen months afterwards. Three tins were full, three empty, one a third full and one two-thirds full.

In a rare event, Cherry-Garrard in the last line of the citation gives the numbers. No complicated math is required to calculate what leakage was recorded due to oil tin storage. The result is 3.3% volume leakage per month.

Since the tins at the Barrier depôts were stored for about three months, one would fairly calculate that a leakage of about 10% of volume *could* be observed. Further analysis is even more simple if one recalls Leonard Huxley's figures[26]

> The amount allotted to each unit for the return journey from the South was apparently rather less, being 2/3 gallons for eight days, or 1/48 gallon a day for each man.

The summary of fuel allotted to each party at depôts along the return route of the First Return, Second Return, and Captain Scott's parties is depicted on the scheme below.



The above scheme was derived from Captain Scott's data for his contingency plan of 8 sledging days between depôts. Thus, the fuel allotted to the Captain Scott party of five men was 5/6 gallons per 8 days, or 5/48 of a gallon per five man party and one

day. For simplicity, I will use an approximate figure of 1/10 of a gallon per day for five men, instead of 5/48.

Returning to possible fuel leakage, I recall that it could amount to about 10% volume, which is roughly about one day's fuel consumption (planned usage). Therefore, in the case of the Captain Scott party, the leakage, if it occurred, would only limit an 8 days fuel quota to roughly 7 full days of sledging.

Since the Captain Scott party accelerated ahead of the 144-days schedule and reached the respective depôts more frequently (see Fig. 9.3) than every seven days, the party sledged at more than their full fuel share. Additionally, if one recalls that on Feb. 24th, 1912 the party sledged with four men, since Edgar Evans had been dead for exactly one week, the conclusion is palpable.

> There was no shortage of fuel experienced by the Captain Scott party.

It is pertinent to add that I am very much aware of their natural want of a civilized man's comforts, including food and normal living conditions. However, I am arguing that Captain Scott did not experience a shortage of food and fuel within his original plan of a 144-days journey. Additionally, I am not arguing that the originally used food/fuel rations were sufficient to cover the energy expenditure of the Captain Scott party, especially during the Antarctic Plateau stage.

To close this section, let me point out one more time that it was not only Captain Scott who was ready to falsify data related to his expedition. Certainly, he lied to the public, as I have shown above, by saying that there was "a shortage of fuel in our depôts for which I cannot account". Captain Scott's selection of misfortunes are peculiar and indeed telling. These misfortunes are:

- Extreme Cold Snap,
- Never Ending Gale,
- Tin Leakage.

The common theme of Captain Scott's misfortunes was their transient behavior. Captain Scott reasoned, or was expecting/assuming that it would not be impossible for future scrutiny to figure and retrieve these transient and temporary phenomena.

However, Captain Scott was not the only one involved in the cover up. In the preceding chapters, we have seen many instances of exaggerations, data dragging and data falsification. Let me, in conjunction with the tin leakage, finish this section with one more example how one tin leaking can be reported as many.

The Captain Scott search party set out on Oct. 29th, 1912, and after several days of journeying towards the One Ton Depôt, Dr Atkinson described the events[27]

> On the night of the 10th and morning of the 11th [November 1912] we made One Ton Depot, coming up five and three-quarters miles to it. I decided to give men and animals a halfday's rest here. It was a beautiful sunny and bright day but with some wind. Here we found the stores which had been left by Demetri [Dmitrii] and Cherry-Garrard. One of the tins of paraffin on top of the cairns had leaked and spoilt some of the stores placed at the foot of the camp. There was no hole of any kind in this tin.

It is clear from Dr Atkinson's description that only "One [*sic*] of the tins of paraffin on top of the cairns had leaked". Moreover,Dr Atkinson informs that "There was no hole of any kind in this tin [*sic*]." There was one and only one tin which apparently leaked.

Although it was one tin for Dr Atkinson, for Cherry-Garrard it was more, and he multiplied the number of tins[28]

> When the search party reached One Ton Camp in November 1912 they found that some of the food, stacked in a canvas 'tank' at the foot of the cairn, was quite oily from the spontaneous leakage of the tins [*sic*] seven feet above it on the top of the cairn.

The conclusion is palpable.

9.3. Captain Scott's Food Supply and *Glossopteris Indica*

> *Wonderful is the effect of impudent and persevering lying. The British ministry have so long hired their gazetteers to repeat and model into every form lies about our being in anarchy, that the world has at length believed them, the English nation has believed them, the ministers themselves have come to believe them, and what is more wonderful, we have believed them ourselves.*
>
> Thomas Jefferson[29]

In the preceding section, I analyzed fuel shortages reported by Captain Scott. It was shown there that in reality, and within the 144-days schedule plan, the party did not experience a fuel shortage. While writing the previous section, I used the slash punctuation for a description of the alleged fuel/food shortages. However, only analysis of fuel usage was presented. In the current section, I will look more carefully at food shortages reported by Captain Scott.

Let me recall and *stress* that the Captain Scott party, from Hut Point to the South Pole and the journey back, was sledging on a tight food, fuel, and time schedule. Presumably, it was Captain Scott's 144-days schedule, which determined where the food and fuel rations were depôted along the route.

In this section, I will one more time make use of the *cæteris paribus* assumption that all of Captain Scott's comments must be the same as was assumed in a 144-days schedule, that is if the distance between depôts was 7 days, then Captain Scott would have had 1 X.S. ration (for 4 men for 7 days) of food/fuel depôted. Consequently, on day #6 the party consumed its 6th daily ration and 1 daily ration was left for the 7th day. Therefore, in the evening of say the 6th day, Captain Scott would have had at his disposal 1 daily ration for the next day, with which the next depot was reached. Consequently, the party was right on schedule and was not short on food.

In Table 9.2, I summarized Captain Scott's comments on food starting from Jan 27th until Feb. 18th, 1912, when the party reached Shambles Camp. What follows is directly connected to this table, and the reader may consult it or Captain Scott's original entries in conjunction to my analysis.

Firstly, one should observe that on Feb. 1st, 1912, Captain Scott accounts that the party is in possession of "8 days' food in hand (full feeding)". This is indeed a correct entry, and the curious reader may follow the count of food rations as given in Tab. 9.2.

On Feb. 6th however, Captain Scott commented that "Food is low". One more time one can count the rations from the Feb. 1st correct food entry, and one finds that

Table 9.2. The Captain Scott party's food rations and Captain Scott's respective comments about food and the Party's situation. The format for food rations is (daily rations consumed as of that day) out of (total collected daily rations for the party as a whole).

Date	Sledging Day	Scott Comments on Food (my comment in italic)	Food Rations
Jan. 27th	86	It is now less than 60 miles and we have a full week's food (35 rations).	1 out of 7
Jan. 28th	87	We are 43 miles from the depot with six days' food (30 rations) in hand.	2 out of 7
Jan. 29th	88	We are certainly getting hungrier every day…The day after tomorrow we should be able to increase allowances.	3 out of 7
Jan. 30th	89	*No specific comments*	4 out of 7
Jan. 31st	Three Degree (3°)	We marched on the depôt, picked it up, and lunched an hour later	$5^1/_7$* out of 14*
Feb. 1st	91	8 days' food (40 rations) in hand (full feeding).	$6^2/_7$ out of 14
Feb. 2nd	92	The extra food is certainly helping us, but we are getting pretty hungry.	$7^3/_7$ out of 14
Feb. 3rd	93	The extra food is doing us all good, but we ought to have more sleep.	$8^4/_7$ out of 14
Feb. 4th	94	Thank the Lord we have good food at each meal, but we get hungrier in spite of it.	$9^5/_7$ out of 14
Feb. 5th	95	*No specific comments*	$10^6/_7$ out of 14
Feb. 6th	96	Food is low	12 out of 14
Feb. 7th	Upper Glacier Depôt	First panic, certainty that biscuit-box was short. Great doubt as to how this has come about, as we certainly haven't over-issued allowances [*sic*, actually he had deliberately done so – KS]. Bowers is dreadfully disturbed about it. The shortage is a full day's allowance.	13 out of 21**
Feb. 8th	98	*No specific comments*	14 out of 21
Feb. 9th	99	Our food satisfies now, but we must march to keep in the full ration	15 out of 21

Date	Sledging Day	Scott Comments on Food (my comment in italic)	Food Rations
Feb. 10th	100	However, if the weather doesn't clear by to-morrow, we must either march blindly on or reduce food.	16 out of 21
Feb. 11th	101	We had three pemmican meals left and decided to make them into four. To-morrow's lunch must serve for two if we do not make big progress.	17 out of 21
Feb. 12th	102	In a very critical situation	18 out of 21
Feb. 13th	Middle Glacier Depôt	At 9 we got up, deciding to have tea, and with one biscuit, no pemmican, so as to leave our scanty remaining meal for eventualities…we were soon in possession of our 3½ days' food. The relief to all is inexpressible; needless to say, we camped and had a meal…In future food must be worked so that we do not run so short if the weather fails us.	19 out of 24.5
Feb. 14th	104	We can't risk opening out our food again, and as cook at present I am serving something under full allowance…We cannot do distance without the ponies. The next depot [The Lower Glacier Depot] some 30 miles away and nearly 3 days' food in hand	20 out of 24.5
Feb. 15th	105	We have reduced food, also sleep; feeling rather done. Trust 1½ days or 2 at most will see us at depôt.	21 out of 24.5
Feb. 16th	106	We are on short rations with not very short food; spin out till to-morrow night.	22 out of 24.5
Feb. 17th	107	*Evans died*	23 out of 24.5
Feb. 18th	Shambles Camp	Here with plenty of horsemeat we have had a fine supper	24 out of 24.5 + $^1/_5$ made available by P. O. Evans' death + a massive amount of horsemeat

* On Jan. 31st, 1912, Captain Scott increased the daily food ration by $^1/_7$, as stated in his diary entries for Jan. 29th and Feb. 1st. In my calculations, it was assumed that the ration increase was ended on Feb. 7th when the "shortage" was discovered.

** Assuming that the party found only 6 instead of 7 rations at Upper Glacier Depôt, the following figures from Feb. 7th will still not change the conclusions.

on Feb. 6th, even after taking into account the issuing of supplementary rations to each man (see Tab. 9.2), the party was in possession of 2 daily rations. That means that a day before reaching the Upper Glacier Depôt with possession of 7 days rations, Captain Scott's comment that "Food is low" is an overstatement.

Although the reader is asked to read and evaluate respective entries in Table 9.2, let us skip a few days and move on to Feb. 12th. On this day, and just a day before arriving at the Middle Glacier Depôt, Captain Scott comments that the party is "In a very critical situation". How come? Simple calculations show that on Feb. 12th, 3 daily rations remained available to the party (see Table 9.2). Provided that the following day after arriving at Middle Glacier Depôt the party collected 3½ daily rations, Captain Scott's anxiety seems to be entirely unfounded.

In the following days until the party arrived at Shambles Camp, Captain Scott's references to shortages of food supply is also groundless, as depicted in Tab. 9.2. On Feb. 16th, two marches from Shambles Camp with at hand 2½ daily rations of food Captain Scott comments, "We are on short rations". The investigative reader rightly wonders what Captain Scott meant by actually writing that. From the factual position and before reaching Shambles Camp the party would have had a ½ of daily rations in their possession. With the perspective that the party would find their plethora of horsemeat, Captain Scott's comment can be described as unfounded manipulation and stretching the truth.

Thus it is evident from the above discussion and from Table 9.2 that just before reaching the Upper Glacier Depôt, Captain Scott starts to make cognitive distortions by introducing catastrophic statements. Before us, we can apparently see Captain Scott's bravado melt away. Right away, one wonders about Captain Scott's mental state. What happened to this sanguine man, who about fifty days before on Dec. 17th, 1911 commented

> If we can keep up the pace, we gain on Shackleton, and I don't see any reason why we shouldn't, except that more pressure is showing up ahead. For once one can say 'sufficient for the day is the good thereof.' Our luck may be on the turn I think we deserve it. In spite of the hard work everyone is very fit and very cheerful, feeling well fed and eager for more toil.

In conjunction to the above self-esteemed comments and the later unfounded remarks by Captain Scott about food shortages, one may rightly wonder about food-related decisions taken at Shambles Camp. We do not know exactly how much horsemeat was retrieved and dragged on the sledge; however, we know that it was not much. Ignoring this issue one must immediately face the riddle: why instead of dropping 35 ℔ of geological specimens at Shambles Camp and carrying a note detailing their location to be found later, did Captain Scott not salvage a mere 35 ℔ of horsemeat for his party? It is incredibly disturbing that for the Captain Scott party, the geological samples were more important than food to eliminate their hunger and calorie deficit.

One starts to wonder about Captain Scott's comments about food shortages, but also about the benefits of the additional food consumption

> [Jan. 29th] We are certainly getting hungrier every day … The day after tomorrow we should be able to increase allowances.

> [Feb. 2nd] The extra food is certainly helping us, but we are getting pretty hungry.
> [Feb. 4th] Thank the Lord we have good food at each meal, but we get hungrier in spite of it.

These particular comments by Captain Scott clearly show that despite the fact that the party was consuming its scheduled food rations, the party suffered from additional food wants. This consequently shows what was confirmed years later, that Captain Scott's party food rations were insufficient for their energy expenditure. Therefore, gradually day after day the party was getting more and more underfed and malnourished. It was erroneously assumed by Captain Scott in the planning stage that the party could use the same food rations at the beginning and after the ponies had been shot.

During the South Pole trek, Captain Scott would have made several changes to the originally envisioned plan. The most notable and groundlessly questioned, by some authors, was to decide to take an extra man, Lt Bowers, to the Pole. This alone shows that Captain Scott did not stick mindlessly to the plan, and was competent enough to introduce modifications and changes.

In a similar fashion, Captain Scott did not explicitly plan to collect geological samples. It came rather as an opportunity, albeit an opportunity exploitable by using a false pretense of science. In the middle of the food rations crisis described by Captain Scott, as discussed above and presented in Tab. 9.2, the party on Feb. 8th and 9th

> [Feb. 8th] Steered in for Mt. Darwin to visit rock. Sent Bowers on, on ski, as Wilson can't wear his at present. He obtained several specimens, all of much the same type, a close-grained granite rock which weathers red … We lunched at 2 well down towards Mt. Buckley … We decided to steer for the moraine under Mt. Buckley and, pulling with crampons, we crossed some very irregular steep slopes with big crevasses and slid down towards the rocks. The moraine was obviously so interesting that when we had advanced some miles and got out of the wind, I decided to camp and spend the rest of the day geologising. It has been extremely interesting. We found ourselves under perpendicular cliffs of Beacon sandstone, weathering rapidly and carrying veritable coal seams … I decided to camp and spend the rest of the day geologising.
>
> [Feb. 9th] Kept along the edge of moraine to the end of Mt. Buckley. Stopped and geologised.

It is indeed entirely incomprehensible why Captain Scott spent the time to geologize if he was really facing food shortages. A little more than four years before Captain Scott's party was descending the Beardmore Glacier, Lt Shackleton and his party were traversing it in the opposite direction. On Dec. 10th, 1908, Lt Shackleton observed[30]

> The rocks of the moraine are remarkable, being of every hue and description. I cannot describe them, but we will carry specimens back for the geologists to deal with. The main rocks of the "Cloudmaker," the mountain under which we are camped, appear to be slates, reef-quartz and a very hard, dark brown rock, the name of which I do not know. The erratics of marble,

> conglomerate and breccia are beautiful, showing a great mass of wonderful colours, but these rocks we cannot take away. We can only take with us small specimens of the main rocks, as weight is of importance to us [*sic*], and from these small specimens the geologists must determine the general character of the land … I climbed about 600 ft. up the mountain and got specimens of the main rocks *in situ*.

It is evident from Lt Shackleton's description above that for him, the weight of specimens was of importance. This is clearly against Cherry-Garrard's nonsensical observations that the net weight of sledge does not influence the energy expenditure of man-hauling.[31]

Lt Shackleton's concerns related to the weight of rock samples collected by him represent a sharp counterexample to Captain Scott's non-existent reasoning for pointlessly dragging about 35 ℔ of specimens. On Feb. 8th when the party stopped and went to geologize they were at –85.00 (85°S), and one can argue that since there were written Captain Scott orders to Meares to meet the party at about 82 – 82.3°S, there was some merit to drag these specimens until this presumed location. The party reached 82°S on Feb. 26th/27th, but it was not until Mar. 10th (–80.51667) that Captain Scott made reference to Meares when he wrote

> The dogs which would have been our salvation have evidently failed. Meares had a bad trip home I suppose.

It is surprising indeed that Captain Scott recalled his own orders with such a delay. I will discuss all pertinent issues in Chapter 10, and in here I only ask why Captain Scott did not implement a contingency plan in the event that Meares would not show up.

Since the party, according to Captain Scott, was facing food and fuel shortages, it is hard to figure out the rationale behind Captain Scott's collecting and dragging 35 ℔ of specimens. The only acceptable scenarios combining scientific pursuit and Captain Scott's responsibility of saving and caring for his and his comrades' lives could be like this.

Scenario I.

Initially after collecting 35 ℔ of specimens, the party could carry them on the sledge. However, every day at suitable occasions, Dr Wilson and say Captain Scott could have examined each collected sample and decided about its worthiness for carrying it further on the sledge. Samples with different and clear imprints should have been retained. After grouping the specimens into different categories, the clearest and biggest specimens should have been identified. In the meantime, Dr Wilson, who was an outstanding drawer of the natural world, should have made the required number of drawings of specimens, and discarded the specimens as soon as the drawing was completed. Alternatively, these samples could have been retained until the expected meeting with Meares. Since Meares did not arrive on the expected date, a well-marked geographical location cairn should have been built and the specimens deposited there. The drawings could be carried with the party, along with a note detailing the location of the specimens and requesting their later retrieval. Thus, the net weight of specimens should be greatly lowered, and the proof of vegetation during

the prehistory of Antarctica clearly obtained. As we will see in subsection 11.1.13, this scenario was declared valid by both Commander Evans and Captain Scott, yet the latter unconscionably rejected it.

Scenario II.
Since the Captain Scott party essentially sledged the same route to and from the Pole, one can understand that Captain Scott's party was twice at the Mt. Darwin location on Dec. 21st – 22nd, 1911, and Feb. 8th – 9th, 1912. Therefore, the same amount of time could have been spent geologizing in December and interesting specimens could have been taken back to Hut Point by the First and Second Return Parties.

By selecting Scenarios I or II, the party would not have had to drag pounds of useless rock, and would have saved energy. Bizarrely, the Captain Scott party dragged all 35 ℔ of rock specimens to the end. Was it not obvious to them that even one specimen with an imprint of a plant, say one named *Glossopteris indica*, would have been sufficient to prove the existence of vegetation in Antarctica? One can go even further, and rightly say that only one good and precise drawing of a *Glossopteris indica* fossil would have satisfied the scientific community, which certainly did not demand the death of Captain Scott's party to obtain physical evidence in the form of pieces of rock. More importantly, at the beginning of the twentieth century, the scientific community did not need fossils from Antarctica to formulate the continental drift theory, which was first presented by Alfred Wegener to the German Geological Society on Jan. 6th, 1912, when the Captain Scott party was exactly 111 miles from the South Pole. Therefore, it is doubtful to state that Captain Scott's specimens helped to prove that all today's continents once formed part of Gondwana as we know it.

It appears that back in the early twentieth century, the hypothesis of continental drift was developed on the basis of other evidence than the *Glossopteris indica* specimens collected by the Captain Scott party. I am not suggesting that later on these specimens did not contribute to support the original Wegener hypothesis publicly presented in 1912, though I would be correct in doing so. Unfortunately, some authors (a recent prime example being Edward Larson), many polar enthusiasts, and the British press were persuaded/determined to claim that the specimens collected by Captain Scott's party were of central importance to the formulation of the continental drift hypothesis/eventual theory. These people, plus the Internet and a gullible news media, resulted in a storm of hype for these specimens.

Even in *A History of Antarctic Science*, written by Dr Gordon E. Fogg, the matter is not set in a straightmanner but rather as non-scientific, opportunistic comments[32]

> At Wilson's request and without demur from Scott, 35 ℔ (16 kg) of rock samples from there were carried with them for the remaining 50 days of their journey and this extra weight may [*sic*] well have contributed to their deaths [*sic*]. To dismiss these specimens as worth of almost nothing and the carrying of them as 'a pathetic little gesture to selvedge something from defeat at the Pole' as Huntford (1979) does, is the judgement of a non-scientist [*sic*] bent on creating sensation by debunking a legend. The 'beautifully traced leaves' were, in fact, the first *Glossopteris* material to be recorded from Antarctica, establishing the age of the coal-bearing rocks of Victoria Land as late Palaeozoic and

> linking them with similar formations on other land masses in the southern hemisphere. Wilson and Scott did make a significant contribution by not jettisoning [*sic*] them (Seward, 1914 [*sic*]; Priestley & Tilley, 1928 [*sic*]; Young, 1980; Tingey, 1983 [*sic*]) and more ought to have been made of them later in the context of continental drift. Publication of the geological results of Scott's last expedition was piecemeal and slow, the final collection of papers not appearing until 1964 [*sic*] (British Museum, 1964).

This has much to say about Dr Fogg's opinion of Captain Scott's justification for dragging the specimens, their importance to science, and developing the continental drift hypothesis. Why does Dr Fogg dance around the issue, instead of citing an article or book which in a direct way was using the Captain Scott party's *Glossopteris* specimen? Before answering this question, let me address Dr Fogg's other comments highlighted above by the Latin verb [*sic*].

In the first instance, Dr Fogg makes the conjunction that the "extra weight may well have contributed to their deaths". Thinking outside the box about this comment, the investigative reader could ask: is it possible, according to Dr Fogg, that any weight might contribute to a sledging party's deaths? Certainly if an *extra* weight does, then *any* extra weight does the same. This is obviously a tautology. Additionally, it does not take into account that on the Barrier the party was sledging from depôt to depôt and the weight of food/fuel was *variable*. It was at its maximum at the departure, and at its minimum at arrival at the depôt. Thus, the weight of the specimens would have grown in proportion to the sledge's overall weight after each depot until the next depot was reached. Moreover, is Dr Fogg suggesting that even more horsemeat than was taken from Shambles Camp could contribute to the party's deaths? And finally, Dr Fogg seems not to remember Cherry-Garrard's assessment that I discussed in subsection 3.1.2[33]

> the friction surfaces of the snow on the runners which mattered and not the dead weight, which in this case [by adding 35 ℔ rock specimens] was almost negligible.

The second comment by Dr Fogg is related to Roland Huntford, who as a "non-scientist" apparently has no right to make a judgment over the real value of specimens collected by the apparently scientific Captain Scott party. Years after Dr Fogg's comments, as I described in section 5.2, Sir Ranulph Fiennes – due to his polar experience – in a similar fashion attributed to himself the right of describing and understanding Captain Scott's actions.

Dr Fogg's above comments are insignificant, and indeed negligible in comparison to what comes towards the end of his justification of Captain Scott's dragging of the specimens. Let me for clarity recall these lines here

> Wilson and Scott did make a significant contribution by not jettisoning [*sic*] them (Seward, 1914 [*sic*]; Priestley & Tilley, 1928 [*sic*]; Young, 1980; Tingey [*sic*], 1983) and more [*sic*] ought to have been made of them later in the context of continental drift.

The investigative reader must be astonished to read that according to Dr Fogg, the most significant contribution related to the specimens by Dr Wilson and Captain

Scott "was not jettisoning them"! A terribly confusing causality. This suggests the very collection of specimens was the Captain Scott party's most important contribution.

However, the real problem with Dr Fogg's above observation is that he –in line with fellows like Dr Solomon – falsely supports his allegation by false citation of other researchers; Seward, Priestley and Tilly, and Tingey's works. If Dr Fogg's comment is taken for granted, as one would do when reading the work of an elected Fellow of the Royal Society[34] published by Cambridge University Press, one would believe the author's embarrassing "jettisoning" notion. However, the investigative reader may consult the cited sources and easily find that Fogg deliberately misinterprets these authors' intentions.

Let us look more carefully at the last author from the list, Robert J. Tingey, and his cited work, titled *Heroic Age Geology in Victoria Land, Antarctica*.[35] The paper is divided into four subsections dedicated to geological results of the *Discovery*, *Nimrod* and *Terra Nova Expeditions*. The fourth section, titled *The Specimens Collected by the Polar Party*, is devoted to Captain Scott's specimens collected from Mount Buckley of the Beardmore Glacier, and Tingey relates

> These fossils, together with moraine specimens collected farther north by Priestly, were discussed by Seward (1914) in relation to Antarctica and Gondwanaland. The original concept of Gondwanaland, postulated by Suess in the late 19th century, envisaged that geological similarities between the southern continents and peninsular India were due to a linking of these land masses by since-foundered land connections; it long pre-dated Alfred Wegener's concept of continental drift, which was very new, controversial, and not widely accepted at the time when Seward was writing. However, when the continental drift theory came later to be considered seriously by English-speaking scientists, Alexander du Toit apparently did not, as Young (1980) states, 'rely heavily on the "Terra Nova" expedition samples in demonstrating the geological connection between Antarctica and other continents'. In *Our wandering continents* du Toit (1937) made no reference in his bibliography either to the *Terra Nova* expedition or to Seward's (1914) description of the plant fossils, and only a passing text reference to the presence of Glossopteris-bearing rocks in Antarctica. Du Toit does refer (p 129) to the 'Gondwana Beacon Sandstone … within 300 miles from the Pole', a statement matched in Seward (1914) by the phrase 'the occurrence 300 miles from the Pole [of] impression of leaves of Glossopteris'; but the only Antarctic work listed in the bibliography is that of Gould (1935), geologist with the American Antarctic expeditions led by Richard. E. Byrd. Thus Young (1980) probably overstates the significance of the rock specimens found with Scott, Wilson and Bowers, and is probably incorrect in asserting that Wilson's 'careful descriptions of the banding of the outcrops [were] among the most precious data which could possibly have been obtained for geology anywhere in the world.' The specimens were, however, thought of highly in their time

Tingey's account of the Captain Scott specimens not only clearly shows that the role of these samples was indeed marginal, if at all, in the development of the continental drift hypothesis, but that Dr Fogg's account, mentioned before, is inaccurate and misleading. Examination of Alexander du Toit's work confirms that Tingey was

right when he documented Young's false citation: du Toit indeed makes no mention of the Captain Scott party's specimens, though there are several non-scientific works about Antarctica in du Toit's bibliography. This same Young paper, with its false citation as documented by Tingey, was cited by Dr Fogg above.

Consultation of Priestley and Tilley's work, titled *Geological Problems of Antarctica*[36], reveals that Dr Fogg also falsely cited them in support of his statement that they "did make a significant contribution by not jettisoning them". Priestley and Tilley did not make the statement Dr Fogg would have us believe, but rather cited the Captain Scott party as the latest example of a noble tradition of sticking to specimens, even if not always in situations as dire

> If the geology and the glaciology of the continent is to be elucidated, the example of Scott and his devoted companions must be emulated in the future as it has been paralleled in the past by many parties whose fate has been less tragic. It is in one sense fortunate for Antarctic science that the poles have been removed from the sphere of the unknown and, therefore, to a great extent, from among the major objectives of the explorer of the future.

Incidentally, Dr Fogg does not mention Priestley and Tilley's parting shot at the end of their paper

> All these problems become very simple to the ardent advocates of Wegener's hypothesis of continental drift, but to the writers of the present article the paleoclimatological evidence from this particular continent presents an insuperable obstacle to the acceptance of this most fascinating and all-embracing theory of modern geology.

Consultation of Seward's work reveals yet more false citation by Dr Fogg, as Seward does not make any mention of the issue of jettisoning the specimens.[37] Thus, all of Dr Fogg's citations are either false or a citation of a false citation. Dr Fogg – and all of those who peddle the myth that the Captain Scott party's *Glossopteris indica* fossil proved the continental drift hypothesis – brings to mind once more the words of George Orwell in his essay *Notes on Nationalism*[38]

> Every nationalist is haunted by the belief that the past can be altered. He spends part of his time in a fantasy world in which things happen as they should – in which, for example, the Spanish Armada was a success or the Russian Revolution was crushed in 1918 – and he will transfer fragments of this world to the history books whenever possible. Much of the propagandist writing of our time amounts to plain forgery. Material facts are suppressed, dates altered, quotations removed from their context and doctored so as to change their meaning. Events which it is felt ought not to have happened are left unmentioned and ultimately denied.

In addition to the above, and thinking in terms of priority, one has to add that during the first Captain Scott expedition, the *Discovery Expedition*, extensive geological work had been done and[39]

> The presence of members of the Glossopteris flora in Antarctica was first attested by the material collected from Mount Buckley by Dr. Wilson and

> Lieut. Bowers on Capt. Scott's last expedition to the South Pole and the now famous specimens were described by Professor A. C. Seward (1914). Traces of fossil plants in Antarctica, were, however, first discovered by Mr. H. T. Ferrar, a member of the National Antarctic Expedition, 1901–1904, and were briefly described by Arber (1907), who reported, on some specimens from the Ferrar Glacier, that "several of these show fair-sized carbonaceous impressions or markings, which in all probability are of vegetable origin". The evidence presented by this unpromising material did not "permit of any opinion as to the botanical nature or affinities of the fossils themselves, nor of the geological age of the beds in which they occur" (Arber, 1907, p. 48). Professor Seward examined the specimens and agreed with this conclusion (1914, p. 2).

The above historical evidence clearly shows that the specimens collected by the Captain Scott party in no way contributed to the formulation or confirmation of the continental drift hypothesis. None other than *Terra Nova Expedition* geologist Raymond E. Priestley rejected continental drift despite the specimens. Therefore, all those who argue to the contrary are simply wrong, including Lieutenant Colonel Paul Edwards and Lieutenant Commander Paul Hart, who in a havoc-wreaking, pompous, and pathetic way explain why the rocks, and Captain Scott and his team, were so inspiring[40]

> Because Scott refused to let go of these key specimens, even when he knew that he was probably doomed. He clearly understood their importance and refused to ditch them until the last, realising that they would probably be recovered with the dead bodies of him and his companions. A brave man until the last.
>
> Knowing that Scott had given his all, and that these rocks went on to provide evidence for the theory of continental drift was, for me, a real inspiration. These rocks went on to be fundamental to our understanding of the planet.

Their thoughts are terribly weak. Captain Scott and his companions were indeed brave men, but the specimens they collected *did not contribute* to the formulation or confirmation of the Continental Drift hypothesis.

However, it must be added that the post-expedition analyses of geological discoveries have been thoroughly analyzed by several authors in subsequent publications. These publications laid the foundation in understanding the geological past and present of the Antarctic continent, and it was Captain Scott's posthumous triumph in facilitating scientific research.[41]

Almost exactly 100 years after Captain Scott stood at the Pole and Dr Wegener finally formulated his hypothesis of Continental Drift, Dr Henry Frankel published a hefty 2160 page comprehensive four-volume tome under the title *The Continental Drift Controversy*.[42] Each of the volumes has a separate sub-tile: Vol. 1: *Wegener and the Early Debate*, Vol. 2: *Paleomagnetism and Confirmation of Drift*, Vol. 3: *Introduction of Seafloor Spreading*, and Vol. 4: *Evolution into Plate Tectonics*. For our purposes, the first volume is of interest and all we need. Shifting through its 632 pages, the reader finds two instances where a reference to Captain's Scott specimens is made.

However, only one of the references could arguably be of some limited significance in the development of the Continental Drift hypothesis. Namely, Dr Frankel on pages 271–272 cites the memories of a South African palaeobotanist, Dr Edna P. Plumstead (1903–1989), who explains

> During my teen years we used to read aloud in the evenings, all the books then appearing on Capt. Scott's Antarctic Expedition [1910–1913] which ended so tragically and where, on the last section of their return from the Pole, Dr. Wilson found and collected specimens of coal and fossil plants (later identified as *Glossopteris*), which he and Capt. Scott carried to their last resting place and which were subsequently described as the most important scientific results of the whole expedition.

Yet again, one has to deal with an ambiguous account. She is not quoting the sources for her account. After consulting Dr Plumstead's CV at Wikipedia, I may presume that she is suggesting the junction between the Captain Scott specimens and continental drift after she joined the Bernard Price Institute in 1965.

Dr Peter Medawar, who received in 1960 a Nobel Prize in Physiology or Medicine, not only advanced scientific knowledge, but also published a little book entitled *Advice to a Young Scientist*. In it, he plainly explained[43]

> Once again we are obliged to draw a distinction between the sufficient and the necessary. For the full unfolding of the human spirit good drains, speedy communication and sound teeth are not sufficient, but they help. There is nothing about poverty, privation, and disease that is conductive to creativity; let no one be taken in by such romantic nonsense.

Clear and simple: no need for martyrdom. Fellow scientists in the early twentieth century demanded suffering from Captain Scott and his comrades in order to obtain whatever scientific samples and/or results from Antarctica. Certainly, they did not ask for their lives to advance scientific knowledge[44]

> To be creative, scientists need libraries and laboratories and the company of other scientist; certainly a quiet and untroubled life is a help. A scientist's work is no way dependent or made more cogent by privation, anxiety, distress or emotional harassment. To be sure, the private lives of scientists may be strangely or even comically mixed up, but not in ways that have any special bearing on the nature and quality of their work.

The investigative reader must wonder: why does anyone need 35 ℔ of specimens from remote mountains in Antarctica? Cherry-Garrard's "practical man of the world"[45] would answer: for scientific reasons. However, without telling the reasons and providing a scientific method of investigation, one is telling nothing. Indeed, much has been written through the ages about scientific methods. Finding effective scientific methods was the dream of many authors. Even serendipity has been admitted as a variety of scientific method. Serendipity played an important role in the scientific exploration of the Earth. However, in complex and uncertain situations, all risks must be evaluated and no man's life put at stake to find or discover a new phenomenon. *Risking a human life to gain knowledge is not a scientific method*.

Figure 9.5. Captain Scott's South Pole party camping on the Beardmore Glacier. In the background, the massive Mount Buckley is *clearly* visible. Its sedimentary structure is also evident. The picture was most probably taken on Dec. 20th, 1911. In the original publication of Captain Scott's journal, the above picture was described as "Camp Under the Wild Range".[1] The respective entry in Captain Scott's journal confirms fine weather on Dec. 20th as depicted on the picture "We started the afternoon march in this fog very unpleasantly, but later it gradually lifted, and tonight it is very fine and warm."

[1] Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R.F. Scott, R.N., C.V.O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 344–345.

Let me recall at this moment Captain Scott's first phrase from his *Message to the Public*

> The causes of the disaster are not due to faulty organisation, but to misfortune in all risks which had to be undertaken.

One may rightly ask about the risks Captain Scott was talking? Acts of God or man? From what follows in his *Message*, one observes that Captain Scott attributes the causes of the disaster to acts of God, while man's acts were bound by contingency plans. However, what was Captain Scott's contingency plan in collecting and dragging 35 ℔ of rock specimens?

This *post factum* and unemotional analysis is uncritical of Captain Scott's and Dr Wilson's actions, and does not find good reasons for dragging these specimens. From many people, and especially those at the Natural History Museum who needed 52 years[46] to publish Captain Scott's geological results, one must observe that "the intensity of the conviction that a hypothesis [of specimens importance] is true has no bearing on whether it is true or not".[47] From this perspective, Robert Tingey accurately concluded[48]

> Keeping the geological specimens during these last few weeks appears to me to have been a gesture, possibly an act of desperation, designed as Huntford

> (1979) says 'to salvage something from defeat at the Pole'. To regard it also as designed '… to show themselves martyrs to science' and [*sic*] … 'a pathetic gesture' seems an unwarranted sneer, although Young (1980) does the contrary case no good by embellishment.

Robert Tingey's reward for his insight and courage to point out false citation was to be falsely cited himself, not just by Dr Fogg to prove his non-existent support for the Captain Scott party's decision, but by Tom Griffiths' *Slicing the Silence: Voyaging to Antarctica*[49], to prove that the Captain Scott party's *Glossopteris indica* specimens proved Gondwana as we know it and by implication continental drift theory, and/or outright proved the continental drift hypothesis. Of course no such thing happened, as the Gondwana concept we know today – the supercontinent torn apart by continental drift – did not exist in Captain Scott's day, or for long afterward.

Of a slightly different sort is David Beerling's book *The Emerald Planet: How Plants Changed Earth's History*[50], and its misuse of the Captain Scott party's *Glossopteris indica* fossils. The only difference between it and Griffiths' book is that it does not commit false citation of Tingey. Instead, Beerling commits false citation of the geologist who examined these fossils, Albert C. Seward[51]

> Reassembling the continents into their positions during Permian times revealed that *Glossopteris* once occupied what appeared to be a continuous geographical distribution on a single southern landmass. Here, argued Seward, was strong evidence for the existence of Gondwana. Scott's fossils proved to be the crucial missing piece of evidence that firmed up its existence.

Except that they were not. As Seward himself stated towards the end of his work[52]

> The origin of the higher plants is still an unsolved problem, but knowledge acquired since 1881, the date of Darwin's letter, renders it difficult to escape from the conclusion that that the ancient continent of Gondwana extended to within a short distance of the South Pole or even to the Pole itself, whether as a continuous continent or as an archipelago of islands cannot be determined.

Seward then goes on to conclude that the *Glossopteris* plants must have had their origins in the Antarctic continent, though on what evidence he does not say. He also notes Nordenskiöld's possible land bridge between the South American and Antarctic continents, before ending with the words "The heroic efforts of the polar party were not in vain. They have laid a solid foundation; their success raises hope for the future, and will stimulate their successors to provide material for the superstructure."[53] This is a far cry from "strong evidence for the existence of Gondwana," and "Scott's fossils proved to be the crucial missing piece of evidence that firmed up its existence."

Drs Griffiths and Beerling are established professors at respected universities, Australian National University[54] and the University of Sheffield[55], respectively. Both of them have other accolades, beinga Senior Lecturer at the University of Newcastle-Australia[56] and a Fellow of the Royal Society[57], respectively. Both of them are teaching students as I write this.

Despite all of the above arguments, the reader remains intrigued the by unavoidable question: why did Captain Scott and Dr Wilson not collect geological specimens

while sledging up the Beardmore Glacier, as in my Scenario II? Well in advance of the actual *South Pole Journey*, Captain Scott knew at least two things: that he would follow Lt Shackleton's track, and that Lt Shackleton, in one of the mountains siding the Beardmore Glacier, found scientifically interesting rock specimens.[58] Therefore, from the beginning it was rather obvious for Captain Scott and Dr Wilson that one day during the *South Pole Journey*, they would approach and would be in the proximity of Mount Buckley. This is confirmed by Captain Scott's entry in his journal on June 5th, 1911, right after Griffith Taylor's lecture on the Beardmore Glacier. Captain Scott recorded

> Geologically he explained the rocks found and the problems unsolved. The basement rocks, as to the north, appear to be reddish and grey granites and altered slate (possibly bearing fossils). The Cloudmaker appears to be diorite; Mt. Buckley sedimentary. The suggested formation is of several layers of coal with sandstone above and below; interesting to find if it is so and investigate coal. Wood fossil conifer appears to have come from this-better to get leaves-wrap fossils up for protection.[*sic*]
> …
> Debenham in discussion mentioned usefulness of small chips of rock – many chips from several places are more valuable than few larger specimens.

These are interesting and exploratory comments by Captain Scott, especially that he acknowledges that Mt. Buckley is a sedimentary rock formation. It was known at that time, in the early twentieth century, that fossils are most commonly found in sedimentary rock. Sedimentary rocks like those forming on Mt. Buckley are formed at temperatures and pressures that do not destroy fossil remnants. The size and clarity of fossil imprints are variable.

Since Captain Scott's route to the Pole was essentially the same as the Lt Shackleton party's route, one must notice what was nicely pointed out by the French microbiologist Louis Pasteur in 1854, that "In the fields of observation chance favors only the prepared mind". Indeed, both parties while sledging on the Beardmore Glacier passed by two massive rock formations, named the Cloudmaker and Mount Buckley. These two "mountains" are separated by about 70 miles, yet their geological origin is very different. The Cloudmaker is formed, as recorded by Lt Shackleton of "slates, reef-quartz and a very hard, dark brown rock," contrary to Mount Buckley, whose sedimentary structure is visible from a distance, see Fig. 9.5. Thus, Captain Scott geologizing at Mount Buckley instead of say the Cloudmaker was rational, and it appears that the above mentioned lecture by Taylor was well received.

Mount Buckley is located at (84°58′S, 163°56′E)[59] and the various parties approached this location on the following dates (± 1 day) exactly four times:

- Dec. 20th, 1911 (Main Polar Party),
- Dec. 22nd, 1911 (First Return Party),
- Jan. 15th, 1912 (Second Return Party),
- Feb. 9th, 1912 (Captain Scott Party).

Why did the Captain Scott party, which traversed the longest route, and more importantly spent the longest time on the high Antarctic Plateau, stop at Mount Buckley to geologize? One more time, the investigative reader may envision several scenarios such as these:

- On Dec. 20th Captain Scott and Dr Wilson could collect samples and temporary depôt them at Camp 40 *vis-à-vis* Mt. Buckley,
- The First Return Party could be ordered upon their return to pick the specimens and drag them back to Shambles Camp, where at a later date Meares with his dogs could pick them up and transport them to Hut Point,
- The First Return Party could be ordered to pick up specimens and drag them as far as possible toward Hut Point, leaving at each depôt a written communiqué on the state of affairs,
- The above could also be done by the Second Return Party.

It doesn't take much intellectual cognition to figure out the next scenario.

Scenario III.
Collect specimens *during the ascent* of the Beardmore Glacier and then drag them to Hut Point in relays between consequently returning parties (and Meares) would be the most efficient approach. This scenario could also significantly increase the probability that the specimens would eventually end up at Hut Point. It also would reduce the time spent dragging additional weight on any one party's sledge.

Certainly, if Scenario III was implemented by Captain Scott, it would be the best logistical approach to combine exploration and collecting geological specimens.

It is widely accepted, or taken for granted, that the Captain Scott party dragged the specimens to the very end to ensure that the expected search party would eventually discover their tent, and thus the specimens. Unfortunately, this line of reasoning has a serious logical flaw. If Captain Scott was assuming that the search party would be launched the next season, then he rightly assumed that the party in its search mission would follow the planned route already traversed many times before. Following this route by the search party would not be difficult, especially at the Barrier stage. Consequently, if Captain Scott was carrying a message concerning the specimens with an order for the search party to sledge there and get the depôted specimens, he could ensure effective retrieval of the specimens.

For more on *Glossopteris indica*, see the Appendix to this Chapter.

⋮

Returning to the main subject of this section, which is Captain Scott's food supply and Captain Scott's possible *in situ* actions in relation to collection of specimens, one can observe that while recording a food crisis, Captain Scott could:

- Not stop and geologize,
- Implement scenario I,
- Implement scenario II,
- Implement scenario III,
- In conjunction with scenario I, II and party III implement the scenario adopted by Lt Shackleton,
- Depôt specimens for Meares upon his arrival.

However, none of the above happened. Not only did food shortages not occur in early February 1912, but Captain Scott, against all rationale and natural drive to

survive, dragged an extra 35 ℔ of rocks. In that air of unreality, where were they sledging? To Hut Point?

The above alternative possibilities and their failure to be implemented make the analytically and practically minded reader suspicious. It appears that on the way back from the South Pole, Captain Scott, at least from the Upper Glacier Depôt, was sledging against the underlying principle of surviving and returning to Hut Point as soon as possible.

Let us for the moment assume that Captain Scott was *right* and *accurate* about food and fuel shortages in February 1912. If so, then it is most striking that Captain Scott did not take full advantage of the horse meat "depôted" at Shambles Camp. The party arrived at Shambles Camp on Feb. 18th and Captain Scott noted

> Here with plenty of horsemeat we have had a fine supper, to be followed by others such, and so continue a more plentiful era if we can keep good marches up. New life seems to come with greater food almost immediately, but I am anxious about the Barrier surfaces.

Although Captain Scott clearly could not overlook horsemeat at Shambles Camp, he is not accounting for the reasons for not taking and consuming more horsemeat. Indeed, for the British, on the contrary to Captain Amundsen's party, eating dog flesh was a kind of taboo, but horse meat was not. As Captain Scott recorded on Dec. 4th, 1911 "All the tents are consuming pony flesh and thoroughly enjoying it."

However, at the slaughterhouse called Shambles Camp, the horsemeat was not "stored" as corpses. On the contrary[60]

> When we got to the stopping place all five ponies had been shot and cut up for dog and man food.

One more time, the investigative reader may recall what I discussed in more detail in section 9.1, that on the way to the South Pole at the foot of the Beardmore, each man had to haul about 250 ℔ (113.4 kg). On the way back from the Pole, the Captain Scott party at each stage carried minimal food/fuel rations, and in the worst case started with only one week's supplies. It was roughly the expected case until One Ton Depôt. The weight of each man's daily ration was about 2 ℔. Therefore, a one-week ration per man was about $7 \times 2 = 14$ ℔ (6.35 kg). Consequently, each man during the Beardmore Glacier decent and further on the Barrier was dragging the weight of around 5.6% of the initial weight dragged in the opposite direction.

This surprising figure may explain why Captain Scott decided to drag 35 ℔ of rocks, but it does not explain why the party did not take a substantial load of horsemeat at Shambles Camp. The distance between Shambles Camp and One Ton Depôt is about 227 miles, which according to Captain Scott's 144-day plan, should be traversed in about 23 days. That consequently means that each man could initially at Shambles Camp drag about 23×2 ℔ $= 46$ ℔ (20.9 kg) of rations. This extra horsemeat of 46 ℔, combined with rations collected on the Barrier like a one-week ration of 14 ℔, will give 60 ℔ of initial rations weight to drag per man. Still, this is only 24% of the initial total weight dragged up the Beardmore.

One more time, one asks the perplexing question: why did the Captain Scott party not collect about 50 ℔ of horsemeat at Shambles Camp ,which was already cut up for human consumption? Why? Although it was not known at that time that

Figure 9.6. Looking up the Gateway to Mount Hope from Shambles Camp, Dec. 9th, 1911.

horsemeat contains relatively small amounts of vitamin C, Captain Scott may have rightly assumed that its consumption would have been beneficial to the party. None of that happened. Instead, Captain Scott recorded

> [Feb. 29th] The oil will just about spin out in that event, and we arrive 3 clear days' food in hand. The increase of ration has had an enormously beneficial result.
> [Mar. 4th] We can expect little from man now except the possibility of extra food at the next depot. It will be real bad if we get there and find the same shortage of oil. Shall we get there?
> [Mar. 5th] We talk of all sorts of subjects in the tent, not much of food now, since we decided to take the risk of running a full ration. We simply couldn't go hungry at this time.
> [Mar. 10th] Yesterday we marched up the depôt, Mt. Hooper. Cold comfort. Shortage on our allowance all round. I don't know that anyone is to blame. The dogs which would have been our salvation have evidently failed.* Meares had a bad trip home I suppose.

Again and again, Captain Scott addresses the wrong issues. Captain Scott formulates counterfactual reasons for his party's disaster. This time, he blames Meares' failure to bring the dogs to the desired location as described in his written orders. Additionally, as I discussed previously, the velocity of the party is controlled by its slowest element, in this case man-hauling velocity.

In this situation, one pleasurable contingency scenario could be considered. Not only Captain Scott and Meares knew that at Shambles Camp there was plenty of horsemeat, but also Dr Simpson, Dr Atkinson, and Cherry-Garrard. Therefore Meares, at the time of departure from Hut Point, could have taken the required dog rations to feed the dogs on the route to Shambles Camp and an equal (sufficient)

amount of man rations to be used by the dogs *or* men on route from Shambles Camp to Hut Point. From Tab. 10.6 and related analyses, we know that 1 dog ration ≈ ½ man ration.

The above analysis could have been anticipated by Captain Scott and Dr Simpson, who was at least according to Captain Scott in charge at Cape Evans. Consequently Captain Scott, when considering the possible contingency steps above of significant increased food availability to the party, must load up the respective horse meat at Shambles Camp. The actual amount could vary, depending on Captain Scott's assumptions.

None of the above happened. Dr Simpson and Meares mutinied and escaped from Antarctica (see Chapter 10), while Dr Atkinson and Cherry-Garrard only pretended to be involved in support/rescue missions.

Strangely enough, while fighting for their lives, Captain Scott, Dr Wilson, Captain Oates, and Lt Bowers could not figure that the horsemeat cut and prepared for man consumption in December 1911 could and must be used by them, especially as they were sledging at a very low (about 6%) capacity of rations weight.

Considering the above analysis, one arrives at this conclusion: *Captain Scott's party did not take a load of horse meat from Shambles Camp because the party was not interested in or were not in want of additional food.*

It is indeed a dreadful conclusion. However, how could anyone explain that from a large amount of horsemeat stored at Shambles Camp, the Captain Scott party while sledging at 6% of its net weight capacity took only a very little on Feb. 18th? A week later, Captain Scott recorded

> [Feb. 26th] We are doing well on our food, but we ought to have yet more. I hope the next depôt, now only 50 miles, will find us with enough surplus to open out. The fuel shortage still an anxiety … Fuel is woefully short.
> [Feb. 27th] We must open out on food soon … We talk of little but food, except after meals … 31 miles to depot, 3 days' fuel at a pinch, and 6 days' food … Things begin to look a little better; we can open out a little on food from tomorrow night, I think.

The above is entirely inexplicable. Let me look at this from another angle. The distance from Shambles Camp to Hut Point *via* One Ton Depôt and Corner Camp is about 227 + 118 = 345 miles. It means that within Captain Scott's 144-days sledging plan, the party would need about 34 sledging days to cover the distance. It would mean that each man would consume daily rations of 2 ℔ for a period of 34 days. Altogether, each man initially must drag about 68 ℔. That is only around ⅓ (33%) of total initial dragging weight.

One more time, we see that the Captain Scott party, without previously depôted food rations, could easily (and using only horsemeat collected at Shambles Camp) sledge to Hut Point. The only item which could not be collected at Shambles Camp was the fuel needed to prepare meals. However, I must recall from section 9.2 that the Captain Scott party would have had sufficient amounts of fuel. In addition, as described in subsection 12.4.1, the pony meat could have been sufficiently heated simply by throwing it into the pemmican. Therefore, it is more than certain that the Captain Scott party, on horsemeat collected at Shambles Camp and fuel at depôts alone, could have returned to Hut Point! It is equally certain that horse-chops may be

undercooked and/or not perfect as one could expect. However, they would provide a lot of energy and much-needed vitamin C. There will be more discussion of these facts in subsections 11.1.10 and 11.1.12.

It is indeed a pity that many readers, if not all, believe that the notion of reaching the One Ton Depôt would have been an act of salvation by Captain Scott's party. Nothing could be more wrong than that. On Mar. 11th Captain Scott came up with a surprising assessment of the chances of his party

> Know that 6 miles is about the limit of our endurance now [*sic*], if we get no help from wind or surfaces. We have 7 days' food [*sic*] and should be about 55 miles from One Ton Camp to-night, $6 \times 7 = 42$, leaving us 13 miles short of our distance, even if things get no worse.

Sadly, Captain Scott's account was partial and raised false concerns. At least three questions are pertinent:

- Why is endurance on Mar. 11th only 6 miles per day, and not 10.1 miles as assumed in the 144-days schedule (plan)?,
- Why is Captain Scott on Mar. 11th finally concerned about low sledging velocity?,
- Why is the party short of 1 day's rations to get to One Ton Depôt?

Mar. 11th, 1912 was the 130th sledging day of the Captain Scott party, and on this day the party was about one sledging day ahead of schedule (see Fig. 9.4). From this point of view anyone, including Captain Scott, would say that they were in a good position, with "7 days' food" and 55 miles from One Ton Depôt. While sledging at the scheduled velocity of 10.1 miles/day, the Captain Scott party would need exactly 5 days to cover the distance and arrive at One Ton Depôt on Mar. 16th. However, Captain Scott –*not until* Mar. 11th– finds that the party could sledge only at 6 miles/day velocity.

On Fig. 9.7, I depicted daily distance traversed by the Captain Scott party during the entire expedition. On the same figure, I also depicted a polynomial fit which represents the best fit to a series of daily distances sledged by the Captain Scott party. This solid line also represents the sustainable sledging velocity of the party. Several interesting properties of this polynomial fit can be observed. Despite some temporary fluctuations of daily distance covered by the party, one can see that a fairly smooth polynomial fit was obtained. From this curve, one can define four fuzzy defined stages:

- The first stage: from Hut Point until the party reached Beardmore Glacier, which may be characterized as the party sledging at a roughly steady velocity close to the scheduled 144-days plan,
- The second stage: from the foot of Beardmore Glacier until the South Pole was reached, the party steadily and day after day increased its sledging velocity,
- The third stage: from the South Pole until the Beardmore Glacier was reached, the party was sledging at an accelerating velocity,
- The fourth and last stage: from the entrance of the Beardmore Glacier until the party approached One Ton Depôt, the party's sledging velocity was steadily and systematically decreasing.

The investigative reader may readily recall that before the fourth stage, Captain Scott was very much aware of sledging velocity and progress by making a number of related comments in his journal. Even in the *Message to the Public*, Captain Scott

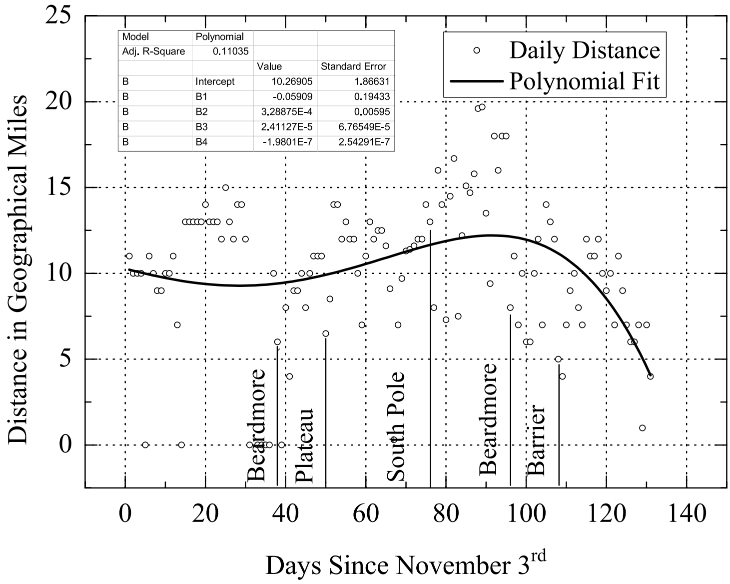


Figure 9.7. Summary of distances traversed by the Captain Scott party during the inward and outward journey to the South Pole. The solid black line represents a polynomial fit to the data points depicted on the figure.

accounts that the four days blizzard in December 1911 significantly contributed to "the causes of the disaster"

> 2. The weather throughout the outward journey, and especially the long gale in 83°S., stopped us.

Indeed, as depicted on Fig. 9.7, the party in December at the foot of the Beardmore Glacier was at a halt. However, this figure, as well as the polynomial fit, shows that the time lost due to the blizzard was quickly regained. Therefore, it did not influence the overall progress of the party.

If for some reason, Captain Scott was thinking that the four days blizzard somehow contributed to disaster, one can, just by looking at the same figure, may rightly ask: why did Captain Scott not think that more than a solid month of steady and systematic sledging velocity was not *a major* reason for the party's disaster? Additionally, if one recalls and observes that Captain Scott, while sledging at very low net sledging weight, did not take a load of horsemeat from Shambles Camp, then a question of the real reasons for the disaster naturally arises. I will return to this thread in Chapter 11.

9.4. Food Shortages on the Barrier

The curious, investigative reader may not be satisfied with Captain Scott's journals, due to the limited technical descriptions and related data. In many circumstances, Captain Scott is more interested in giving his own poetic "impressions" like "the deep,

dreamless sleep that follows the long march and the satisfying supper"[61] than more down to earth accounts of digits and data. Indeed, Captain Scott's acclaimed writing does not help in ascertaining a detailed analysis of events.

In previous subsections of the current chapter, I investigated food, fuel, and depôts issues related to reported fuel shortages and collection of geological specimens. In particular, in section 9.3 I analyzed food/fuel shortages reported by Captain Scott at the beginning of February 1912 (see Tab. 9.2). A careful analysis presented there shows that the returning party did not experience a food shortage, as referred to by Captain Scott. I have in the same chapter also looked at fuel leakage reported by Captain Scott and others. One more time, it was shown there that the recorded leakage did not exceed 10% of the volume. This leakage was indeed unfortunate, and it was possible that 10% of the much-needed volume of fuel leaked and evaporated. However, despite the resulting discomfort because of the leak, one cannot seriously postulate that this fuel shortage led to the Captain Scott party's final disaster.

In this section, I will one more time analyze the Captain Scott party's *real* food/fuel supply from a logistics point of view. I will be concerned with the allotted and depôted food/fuel rations from the foot of the Beardmore Glacier to the South Pole and back to the last minute of Captain Scott's party in March 1912.

Although the number of weekly units rations (12) available to the party during the Plateau stage from the Upper Glacier, the South Pole, and back is evident, a certain number of units designated for the Beardmore Glacier stage is uncertain and contradictory. For example, Cherry-Garrard in his account gives the following account[62]

> The twenty-four weekly units of food were to carry the Polar Party and two supporting parties forward to their farthest point, and back again to the bottom of the Beardmore, where three more units were to be left in a depot.
>
> The ponies had dragged twenty-four weekly units of food for four men to some five miles from the bottom of the glacier, but we were late. For some days we had been eating the Summit ration, that is the food which should not have been touched until the Glacier Depot had been laid, and we were still a day's run from the place where this was to be done: it was of course the result of the blizzard which no one could have expected in December.
>
> Before setting out on December 11 we rigged up the Lower Glacier Depot, three weekly Summit units of provisions, two cases of emergency biscuit which was the ration for three weekly units, and two cans of oil. These provisions were calculated to carry the three returning parties as far as the Southern Barrier Depot. We also left one can of spirit, used for lighting the primus, one bottle of medical brandy and certain spare and personal gear not required. On the sledges themselves we stowed eighteen weekly Summit units, besides the three ready bags containing the ration for the current week, and the complement of biscuit, for this was ten cases in addition to the three boxes of biscuit which the three parties were using. Then there were eighteen cans of oil, with two cans of lighting spirit and a little additional Christmas fare which Bowers had packed.

The numbers given by Cherry-Garrard do not add up, and confuse the reader. It is clear that 3 units were left at the Lower Glacier Depôt for returning parties.

However, how many units were taken up the Beardmore Glacier? Captain Scott conspicuously remains silent on this *vital issue* of his further journey to the Pole.

Before continuing, let me look more closely at this question. Tab. 9.3 combines actual and theoretical usage of food/fuel rations. The theoretical rations available to Captain Scott's party were food/fuel rations *if* his party sledged to and back from the South Pole at a theoretical distance of ~385 miles, and at the originally assumed

Table 9.3. Analysis of various scenarios of food/fuel distribution and consumption for the various parties of the South Pole journey, from the foot of the Beardmore Glacier and back again. The actual and theoretical rations are calculated using the daily individual rations for all the men. The theoretical ration consumption was calculated using the distance and sledging velocity of 10.1 miles/day.

A – Summary Analysis from Lower Glacier Depôt to the South Pole and Back.

Party Name	Actual Time Out (days)	Actual Rations Consumption	Theoretical Time Out (days)	Theoretical Rations Consumption	Initial Rations at Lower Glacier Depot
First Return	19	76	20	80	
Second Return	43	129	48	144	
The Main	70	350	80	400	
Σ	132	555	148	624	22 × 7 × 4 = 616 21 × 7 × 4 = 588 20 × 7 × 4 = 560 19 × 7 × 4 = 532

B – Analysis from Upper Glacier Depot to the South Pole and Back.

Second Return	23	69	29	87	
Main	49	245	59	295	
Σ	72	314		382	13 × 7 × 4 = 364 12 × 7 × 4 = 336 11 × 7 × 4 = 308

C – Analysis from Lower Glacier Depot to Upper Glacier Depot and Back.

First Return	19	76	24	96	
Second Return	19	57	24	72	
Main	24	120	24	120	
Σ	62	253	72	288	10 × 7 × 4 = 280 9 × 7 × 4 = 252

sustained sledging velocity of 10.1 miles/day. Additionally, Captain Scott and/or Lt Bowers had to consider at which moment of time the supporting two parties had to part.

Analysis of Tab. 9.3 has to be made with the knowledge that on Dec. 11th, 1911, at the Lower Glacier Depôt, Captain Scott was about two days behind the schedule (see Fig. 9.1 and 9.4). This 2 days' delay translates to a summary shortage for all three parties of 0.86 food/fuel unit. That was a moment of time when Captain Scott could call off the journey to the Pole. As far as Dec. 11th, Captain Scott was short of food/fuel according to the 144-days schedule. However, there was a way out – increase the daily sledging velocity! This is precisely what Captain Scott did.

Returning to the question of the number of food/fuel units at Captain Scott's disposal at the Lower Glacier Depôt, and comparing Cherry-Garrard's account and estimations presented in Table 9.3, one finds him/herself in a difficult position. It is intriguing that such a vital figure for the expedition is not clearly presented. The only certain piece of information is that at the top of the Beardmore Glacier, at the Upper Glacier Depôt, Captain Scott planned to continue his journey to the Pole with 12 units.[63] Consequently, as provided in Table 9.3 and its C sub-table, Captain Scott may expect that all the parties would need 10 (ten) food/fuel rations to ascend and descend the Beardmore Glacier. Thus, it is fair to think that after depôting three units at the Lower Glacier Depôt to be used by returning parties, the South Pole party left it with the 21 units that Captain Evans described.[64]

Having in mind what has just been addressed above, one could derive educated calculations of food/fuel rations from the Upper Glacier Depôt and onward available to Captain Scott's returning party. Let me recall that the Upper Glacier Depôt was the main and the most important depot, established by Captain Scott right after reaching the Antarctic Plateau on Dec. 21st, 1911. At this moment, Captain Scott was controlling his journey in terms of the 144-days schedule and four man food/fuel units. The logistic plan was indeed simple and did not require elaborate calculations. However, upon Captain Scott's change of adding Lt Bowers to his South Pole party, the logistical plan was altered, as it is shown schematically on Fig. 9.8.

Presented in Tab. 9.2 (section 9.3) are Captain Scott's comments related to food/fuel up to Feb. 18th, when the party, right after Edgar Evans' death, arrived at Shambles Camp next to Lower Glacier Depôt. At the moment of Captain Scott's arrival, his party was in possession of about 5 to 0 of food/fuel daily individual rations. Let me recall that 1 food/fuel unit was a made up unit for a purpose of my calculations, equivalent to merging Captain Scott's X.S. unit of rations with 1 week's fuel for four men. Therefore, one (1) of my units contained 7×4 food/fuel rations to be consumed in one week's sledging time by a party of four men. In reality, food and fuel were stored in separate packages of summit food units and fuel tins. However, since Captain Scott had taken Lt Bowers to the South Pole it was necessary to change the content of a unit. Since Jan 3rd, 1912 (–87.533, 160.6833: No Name Depôt (3° Depôt), see Tab. 9.1), and due to the parting of the Second Return party, units were changed (re-packed) into 5 man units for a given time (sledging distance). During the Antarctic Plateau stage, from No Name Depôt onward to the Pole and back to the Upper Glacier Depôt, the Captain Scott party sledged under strenuous food/fuel conditions, and by increased their sledging velocity the party compensated for the increased food/fuel rations needed for the Fifth Man, Lt Bowers.

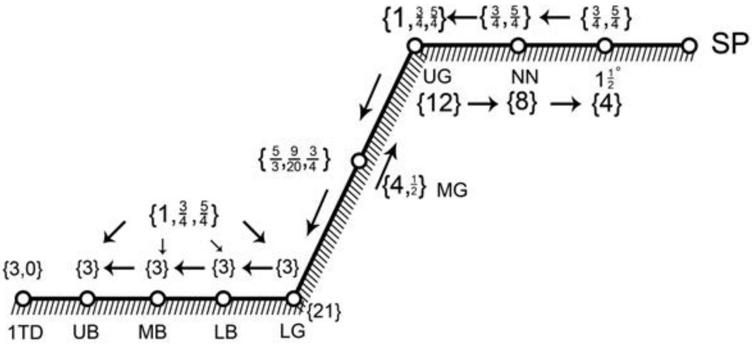


Figure 9.8. Food/fuel depôts available to the First Return, Second Return and Captain Scott parties along the route: *five men* sledging to the Pole was the actual Captain Scott logistics. The *actual food allotted* to each party is denoted by 3-tuple {First, Second, Scott} parties. Food rations are given in integers or fractions of my own units (1 of my units = full food/fuel allowance for 4 men for one week (7 days) time). The following abbreviations have been used: 1TD (One Ton Depôt), MB (Middle Barrier Depôt), LB (Lower Barrier Depôt), LG (Lower Glacier Depôt), MG (Middle Glacier Depôt), UG (Upper Glacier Depôt), 3° (Three Degree (3°) Depôt), NN (No Name Depôt), 1½° (88°29′S Depôt), and SP (South Pole). A very awkward splitting food/fuel rations for returning parties at MG Depôt {$^5/_3$, $^9/_{20}$ (~½), ¾} resulted from an unequal splitting of the distance up (or down) the Beardmore Glacier.

However, as shown in Tab. 9.2, Captain Scott's own account of food/fuel rations at certain days is self-contradictory and/or hard to explain. For example on Feb. 13th, just upon arriving at the Middle Glacier Depôt, Captain Scott plainly commented, "we were soon in possession of our 3½ days' food". It is a confusing comment, as at this depôt 3 four man food/fuel units were originally depôted. The First Return Party took $^5/_3$ unit. The Second Return Party (3 men) took $^9/_{20}$ (~½) unit, and the Captain Scott party (5 men) collected ¾ unit. These rations were to be sufficient to reach the Lower Glacier Depôt within one week's time. Thus Captain Scott's remark of collecting "3½ days' food" at the Middle Glacier Depôt appears to be incorrect, not only because it is 3½ days' food, but also as it does not add up in the overall scheme, as depicted at Fig. 9.8. Recalling that the parties originally dragged 21 units of food/fuel from the foot of the Beardmore Glacier, one must conclude that neither party could sledge down to the Lower Glacier Depôt on 3½ days rations. These provisions were $^9/_{20}$ (~½) and ¾, respectively. The investigative reader, while looking at Tab. 9.2 and the respective Captain Scott remarks/comments, could find further discrepancies and differences.

From the Upper Glacier Depôt and thus descent of the Beardmore Glacier, the Captain Scott party of five men was sledging within its original regime, meaning that regardless of the number of the members of sledging party, the food/fuel stored at each depôt on the way was sufficient to support the party for the 144-days schedule sledging time. That was exactly the case for the First Return Party which consisted of 4 men (Dr Atkinson, Cherry-Garrard, Keohane and Wright), the Second Return Party which consisted of 3 men (Lt Evans, Lashly, Crean), and Captain Scott's 5 man party.

The First Return Party used food/fuel rations as originally envisioned for a four-man party. The Second Return Party, due to taking Lt Bowers to the South Pole, was obliged to re-pack units into packages for three and five men. Thus, re-packed provisions were used by the Second Return Party (3 men). The remaining rations were left for Captain Scott's returning party of 5 men and represented new 5 men food/fuel units.

In Tab. 9.4, I presented a summary of Captain Scott's party return marches from the Upper Glacier Depôt until the very end of the Captain Scott party, together with respective daily individual food/fuel rations. Since the depôts were stocked with rations according to the 144-days schedule, it meant the parties would have been visiting these locations at periods of time determined by this plan, and with a sledging velocity of about 10.1 miles/day. We have seen already in section 9.2 how Captain Scott's sledging velocity contingency worked to perfection after the Fifth Man, Lt Bowers, was taken to the Pole.

Here we will just observe that this contingency was valid until the Captain Scott party reached the Upper Glacier Depôt on the edge of the Beardmore Glacier. From this point on, regardless of the number of people in each party, altogether eight men were supposed to sledge down the glacier and use the depôts with provisions according to the 144-days schedule. This is reflected by the actual and 144-days sledging days, as given in Tab. 9.4. If Captain Scott was accelerating relative to the 144-days schedule, the party was collecting provisions at a higher rate than planned. If the party was consuming exactly one ration per man per day, then the surplus of rations was accumulating.

Since the Captain Scott party was a five-man party, by saving one sledging day the party was saving (obtaining) five daily rations, as indicated on Feb. 13th in Tab. 9.3. At the Lower Glacier Depôt, the Captain Scott party sledged two days ahead of the 144-days schedule and thus saved $2 \times 5 = 10$ daily rations, as indicated in Tab. 9.4 for Feb. 18th. Additionally, following P. O. Evans' death on Feb. 17th, the Captain Scott party gained one (1) daily ration on Feb. 18th as indicated in the last column of Tab. 9.4, and returned to the consumption of 4 daily rations.

From this perspective, Cherry-Garrard's comment appears to give new light[65]

> From the particulars already given it will be seen that I had no reason to suspect that the Polar Party could be in want of food. The Polar Party of five men had according to our rations plenty of food either on their sledge or in the depots. In addition they had a lot of pony meat depôted at Middle Glacier Depot [*sic*][66] and onwards from there. Though we did not know it, the death of Evans at the foot of the Beardmore Glacier provided an additional amount of food for the four men who were then left. The full amount of oil for this food had been left in the depots; but we know now what we did not know then, that some of it had evaporated.

However, not only did poor Cherry-Garrard feel confused. I am too confused and shocked by the analysis of Captain Scott's rations presented above.

The investigative reader may notice certain discrepancies between Captain Scott's comments on food as given in Tab. 9.2 and the summary of food allotted to his party as presented in Tab. 9.3, and subsequently depicted for clarity on Fig. 9.8.

While working on Captain Scott's fabrication of the *Extreme Cold Snap*, I had in mind that the culprit was always eager to hide his machination. It is/was a very

Table 9.4. Summary of the Captain Scott party's food/fuel ration consumption and distributions along their return from the South Pole starting with the Upper Glacier Depôt. The columns indicating actual and 144-schedule sledging days are indicating the respective days counted from Nov. 3rd, 1911, Captain Scott's departure from Hut Point. The next column indicates the actual number of sledging days between depôts. The next column gives the number of daily rations "saved" due to the Captain Scott party's sledging faster than assumed within the 144-days schedule and subsequent distribution of units in depôts. The last column summarizes the surplus of daily individual rations not consumed due to death of P. O. Evans.

Date (1912)	Depôt name	Actual number of sledging days	144-days schedule sledging days	Number of sledging days	Surplus daily rations for all men due to faster sledging	Surplus daily individual rations from depôt due to Evans' death
Feb. 7th	Upper Glacier	97	103	–↓	0→	0
Feb. 13th	Middle Glacier	103	108	6↓	0 + 0→	0
Feb. 17th	Lower Glacier†	108	113	4↓	0 + 0 + 0→	1→
Feb. 24th	Lower Barrier	114	118	7↓	0 + 0 + 0 + 0→	1 + 7→
Mar. 2nd	Middle Barrier	121	125	7↓	0 + 0 + 0 + 0 + 0→	1 + 7 + 7→
Mar. 9th	Upper Barrier	128	130	7↓	0 + 0 + 0 + 0 + 0 + 0→	1 + 7 + 7 + 7
Surplus of daily rations after Captain Scott reached the Upper Barrier Depôt					$7 \times 5 = 35$	Σ22
Mar. 15th	Oates' Death††	134	134	6↓	$57–6 \times 4 = 33$→	0
Mar. 16th	–	135	–	1↓	33–3 = 30→	0
Mar. 26th	–	–	–	10↓	30–30	0
Mar. 26th	–	–	–	–	0	0
–	One Ton Depôt	–	–	–	–	–

† On Feb. 18th, the Lower Glacier Depôt and Shambles Camp with its loads of pony cutlets were reached.

†† Captain Lawrence E. G. Oates died on the next day in the morning. I assumed here that on Mar. 15th, Captain Oates ate his last evening meal. One has also to recall Captain Scott's journal entry: "Friday, March 16 or 17. – lost track of dates, but think the last correct". The Greek letter Σ – sigma (σίγμα) stands for the arithmetical sum of elements (summation operator) under consideration.

culprit-like *sine qua non* reflex. Charging the weather as a cause of the disaster was a natural, easy, and seemingly non-disprovable gamble. Long before the journey to the South Pole, Captain Scott observed

> [Aug. 3rd, 1911] Our expectations have been falsified so often that we feel ourselves wholly incapable as weather prophets therefore one scarce dares to predict a blizzard even in face of such disturbance as exists. A paper handed to Simpson by David, and purporting to contain a description of approaching signs, together with the cause and effect of our blizzards, proves equally hopeless. We have not obtained a single scrap of evidence to verify its statements, and a great number of our observations definitely contradict them. The plain fact is that no two of our storms have been heralded by the same signs.

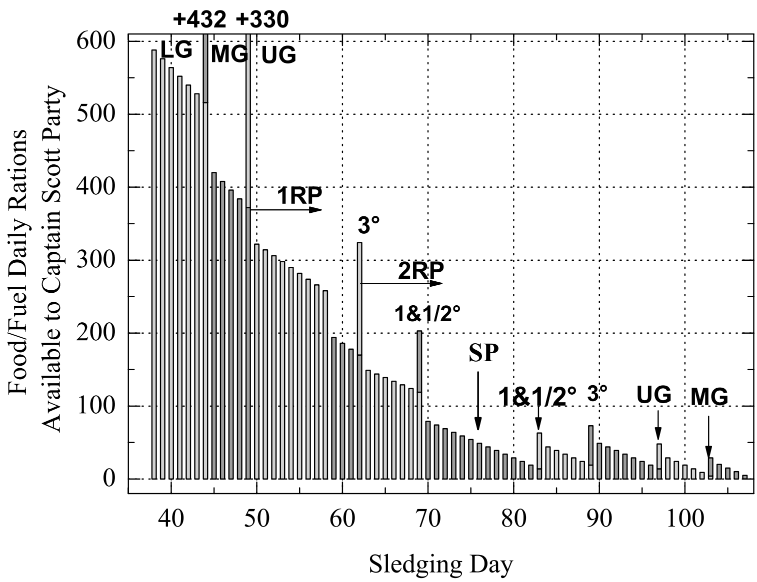


Figure 9.9. Food/fuel daily rations available to Captain Scott's party from the foot of the Beardmore Glacier to the South Pole and back. All abbreviations are the same as these given in the caption of Fig. 9.8. Additionally, 1RP and 2RP denote the dates of the First and the Second Return Parties, respectively. The 2RP did not return on the 62nd (Jan. 3rd, 1912) sledging day as indicated on the figure, but the next day, Jan. 4th, 1912. The initial light grey color columns from the 38th sledging day indicate a number of food/fuel rations initially available to Captain Scott's party at the Lower Glacier Depôt (LG). On the 44th sledging day, the Party established the Middle Glacier Depôt (MG), where 3 units ($3 \times 4 \times 7 = 84$ daily rations) were stored, and the party continued with 432 daily individual rations, as indicated by dark grey columns. On the 49th sledging day, the party established the Upper Glacier Depôt (UG) and 2 ($2 \times 4 \times 7 = 56$ daily rations) units were depôted, with 1 unit taken by 1RP. The rest of the 12 ($12 \times 4 \times 7 = 336$ daily individual rations) units were taken by Captain Scott's party of 8 men, as indicated by light grey columns.

However, alleging food/fuel shortages and falsifying food/fuel rations was another matter, and much, much more detectable. After all, to get a ration count one needs only to apply simple math, contrary to the multidimensional analysis of neural networks required for the weather. Yet Captain Scott chose to manipulate food/fuel data and the count of rations.

Figs. 9.9 and 9.10 illustrate an exact distribution of food/fuel *daily* rations available to Captain Scott's party from the foot of the Beardmore Glacier to and back from the South Pole. As depicted, their rations were actual rations allotted to Captain Scott's party consisting 3×4, 2×4 and 1×5 man parties, respectively. After examining these figures, one arrives at the palpable conclusion in accord with previous observations, that at no instance was Captain Scott's party short of food/fuel during the Beardmore Glacier-South Pole-Beardmore Glacier stage.

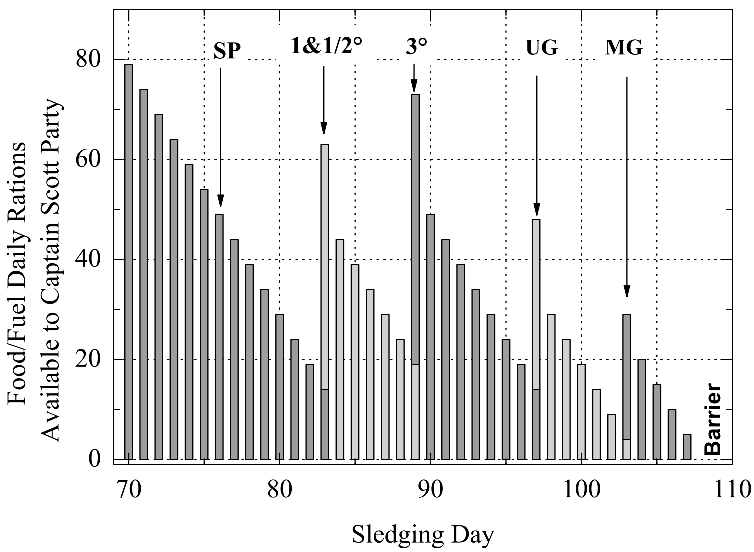


Figure 9.10. A snapshot of Fig. 9.9, from the South Pole (SP) until Captain Scott's party reached the Barrier. All abbreviations and colored columns are described in the caption to Fig. 9.9.

Right after descending from the Beardmore Glacier, the party reached Shambles Camp, and on Feb. 18th Captain Scott noted

> Here [Shambles Camp] with plenty of horsemeat we have had a fine supper, to be followed by others such, and so continue a more plentiful era if we can keep good marches up. New life seems to come with greater food almost immediately, but I am anxious [*sic*] about the Barrier surfaces.

Since the party collected $^5/_4$ unit at the Lower Glacier Depôt located a short distance from Shambles Camp (see Fig. 9.10), the party was indeed sledging light with only one week's rations to get them to the Lower Barrier Depôt. If collected at Shambles Camp, the pony meat could provide *full* food rations for Captain Scott party at least to the One Ton Depôt, *i.e.* 1 month of food for a 4 man party. Since the

pony cutlets at Shambles Camp were "unlimited" (more than they required), and since the self-sustained sledging distance was about 800 miles (2½ months), this estimation is very conservative. Recalling that respective food/fuel rations were depôted along the return route, one is indeed astonished by the fact that somehow Captain Scott's party was short of food.

No rational or otherwise explanation was provided. However, one can presently see the point. The Captain Scott party would have had sufficient food/fuel rations to keep them sledging to One Ton Depôt, and well beyond.

By finding that Captain Scott's party had fair and sufficient rations as accounted in Tab. 9.2, one can easily understand how it was impossible for the Captain Scott party, physically unable to move and deprived of all human physical and psychological necessities, could have stayed alive until at least Mar. 29th having only "fuel to make two cups of tea apiece and bare food for two days on the 20th [March]."

Inevitably, the false and unconfirmed food/fuel shortages described above were had no effect on Captain Scott and his party. The First Return Party sledged back from the Upper Glacier Depôt on full food/fuel rations. This and nothing more proves that the food/fuel rations depôted along the return route were sufficient for a party of four men. The Second Return Party sledged along the same route, but from the No Name Given location (see Tab. 9.1) on the Antarctic Plateau. This party, all the way down to Hut Point, reported only minor fuel leakage, but at no instance reported a food shortage for themselves or concern for the logistics of the Captain Scott party. Why then did Captain Scott suddenly start to report food shortages during the Glacier stage?

The investigative reader will soon learn in Chapter 10 of Captain Scott's orders to Meares (and thus to Dr Simpson) to re-supply One Ton Depôt with 5 X.S. units of food/fuel rations, and wonder about the meaning of these orders. If Captain Scott's returning party before reaching the One Ton Depôt had a surplus of food, then was it required by Dr Simpson or Dr Atkinson to follow Captain Scott's orders to re-supply One Ton Depôt? The answer is of course in the affirmative, as Dr Simpson and Dr Atkinson did not know at the time of actual events that the Captain Scott party – at least until Captain Oates' death – was sledging ahead of the modified 144-days schedule, according to which 7 days food/fuel units for 5 men were depôted along the return route. The surplus of food due to the deaths of P.O. Evans and Captain Oates was also unknown.

In Chapter 10, I will show the insidious and tacit mutiny of Dr Simpson, Dr Atkinson, and the others which took place while Captain Scott was on his journey. The mutiny rested on not delivering 2 X.S. food/fuel units to the One Ton Depôt originally ordered and allotted by Captain Scott to his returning main party. From that time, December 1911 onwards, the cover-up actions had been taken by various mutineers. According to Sir Ranulph Fiennes, in a letter exchange in 1938 between Cherry-Garrard and Dr Simpson, the latter tenaciously and hypocritically explained[67]

> That's quite possible … I would not altogether blame Meares; he wanted to get home and did not want to miss the ship. And of course there was no fear of a disaster then.

One more time, we see how Dr Simpson shifts his responsibilities onto Meares without even mentioning them. Moreover, he is also saying that Meares' actions were as natural as anyone could expect of being interested in returning home, while no

disaster was in sight. Indeed, along with not delivering food to One Ton Depôt, "no fear of a disaster" for the Captain Scott party was present in Dr Simpson's mind, as he expected that they could easily sledge 118 miles without food and fuel.

To secure Dr Simpson's stand on food for the Captain Scott party, Cherry-Garrard without hesitation found a scapegoat to disguise his own wrongdoings. According to Sir Ranulph[68], Cherry-Garrard noted:

> I am afraid it is becoming clear that the not laying of this depot [re-supplying One Tone Depôt] by Meares was more or less deliberate [*sic*]. I have always had a feeling that Meares let the whole show down in some rather indefinite way: I have also had feeling that he got off very lightly.
>
> Meares proved himself a coward when he refused to go down the crevasse which Scott told him to do on the Depot Journey. Some of Scott's decisions not to take dogs to the Pole may have been really that he knows that Meares was not much of good!
>
> As we now know he [Meares] took some of the food of the 3 returning parties from the depots or [*sic*] depot. Then, not having taken out the most urgent rations, which was done by manhauling party, he failed to take out anything else, including the dog food.

The above is indeed a terrifying summary of the *Terra Nova Expedition*, produced by its weakest man who became its member, not because of his talents – Captain Scott originally rejected his application – but because of his substantial donation of £1000 and his willingness to let them keep it despite being initially rejected. I wonder what would have happened if Cherry-Garrard had spent a few British pounds sterling to learn how to use a compass as a navigation device. It is worth reading Cherry-Garrard's odd expounds several times, and compare it with Chapter 10 to fully appreciate their nonsensical, counterfactual, poorly evidenced rhetoric. Teaming up with Dr Simpson was for Cherry-Garrard the most natural thing to do, for anyone embarking on a course of mutiny. Blaming Meares for not delivering food rations for the returning Captain Scott party represents a correct but conveniently incomplete account of events. However, not taking into account that Dr Simpson was at that time in charge of Cape Evans was deceitful. Not recalling that Dr Atkinson took over the command post after Dr Simpson's escape from Antarctica is also hard to explain outside of deceit.

Cherry-Garrard was fully aware (without *post factum* inference) that the amount of 5 X.S. food/fuel rations was absolutely necessary (crucial), and had to be depôted at One Ton Depôt for the returning parties.[69]

> Judge therefore our joy when we [First Return party] reached One Ton in the evening of January 15 to find three of the five XS rations which were necessary for the three parties. A man-hauling party consisting of Day, Nelson, Hooper and Clissold had brought out this food.

In other words, from the perspective of Dr Simpson and Cherry-Garrard, not depôting 2 X.S. units at One Ton Depôt meant certain death due to starvation to the returning Captain Scott party. The Captain Scott party could not have shared Cherry-Garrard's "joy" of finding food/fuel at One Ton Depôt. It was, as I will demonstrate in section 10.1, a cognizant death sentence to the Captain Scott party,

and Cherry-Garrard was not concerned. The critical reader may suggest that since Captain Scott never reached One Ton Depôt, there is no point to ramble on about the issue. I can only presume that the name of this reader is Dr Simpson.

9.5. Lt Shackleton's Shadow

When other authors were analyzing Captain Scott's *South Pole Journey*, as well as the *Terra Nova Expedition* as a whole, it was customary for them to compare it to Captain Amundsen's expedition and the methods he used. Indeed, one may wonder why and how to compare these two journeys to the Pole since both teams used basically different methods of sledging. At the very onset of the race to the Pole, Captain Scott was virtually set to lose it. In a way, Captain Amundsen at the South Pole repeated his *Northwest Passage Expedition*, where he proved that his methods were superior to the whole array of British explorers, including the laden Sir John Franklin.

Surprisingly, very little attention was devoted to a comparison of very similar adventures, like Lt Shackleton's *Nimrod* and Captain Scott's *Terra Nova Expeditions*. In here, I will not venture into summarizing a complete comparison of both expeditions, but will look only at issues pertinent to the present chapter.

In the preceding section, I wondered how Captain Scott arrived at his sledging plan. In particular, how did he figure out his sledging time (144-days) to and back from the South Pole? Certainly, Captain Scott's experience from the *Discovery Expedition* was not telling him much. A little more experience could have been gained from Lt Shackleton's written account, where he considered that his journey to and back from the South Pole would take 93 days and that he eventually figured that he could spin the rations to last about 120 days. The first figure, to sledge the journey in only 93 days, is indeed staggering in its value. It would mean that the daily sledging velocity must be 16.3 geographical miles per day. Even Captain Amundsen's dog teams did not approach this value, see Fig. 4.13. More importantly, no one before Lt Shackleton's suggestion, in the Arctic or Siberia – not to mention Antarctica – was able to sledge for a prolonged time with velocities close to Lt Shackleton's 16.3 miles/day.

So what was Lt Shackleton up to? Was he really thinking that he and his comrades could sustain sledging day after day without a contingency plan? Not long after his departure, due to a number of setbacks, Lt Shackleton re-calculated his journey schedule as a 120 days journey. This meant a reduction of the initial sledging velocity from $\upsilon \approx 16.3$ m/d to $\upsilon \approx 12.5$ m/d.

In reality, as depicted on Fig. 4.11, Lt Shackleton's party travelled over the Barrier stage at 13.6 miles/day. However, during the Plateau stage their velocity was much slower, at about 9 miles/day. That alone, combined with food/fuel rations planned for muchfaster sledging velocities, effectively prohibited Lt Shackleton and his comrades (Adams, Marshal and Wild) from reaching the South Pole, and forced them to turn back short of the pole by ~97.5 geographical miles.

For a long time, I was thinking that the result of reaching the latitude of 88°23′S, achieved by Lt Shackleton, was the absolute maximum which could be made by his or similar methods. To my knowledge, since Lt Shackleton's *Nimrod Expedition* no particular development in nutrition and transportation methods had been proposed, and Captain Scott essentially worked out his South Pole attempt within the Lt Shackleton

scheme. A few organizational differences and peculiarities were ultimately not important for the final result.

This reasoning was based on the silent assumption that the weather conditions during the journeys of both expeditions were similar, as random fluctuations of weather would suggest. Since working on weather retrodiction during the Captain Scott party's return from the Pole, and concluding that the weather conditions were "as usual," I started to look at food/fuel details. My thinking was directed to the notion that the Captain Scott party perished because they did not turn back before sledging to the Pole. Recalling that the distance from the Pole and back is similar to the distance between One Ton Depôt and Hut Point, one may be inclined to accept such a suggestion and explanation.

One of the ending chapters of Sir Ranulph Fiennes' Captain Scott hagiography/Captain Amundsen hatchet job bears the provocative title: *The Greatest March Ever Made*. However, he does not explain what measures of greatness he is willing to attach to Captain Scott's march. We know from Chapter 7 that the Coldest March was a fabrication by Captain Scott. In the case of Sir Ranulph's tribute to Captain Scott's *Greatest March Ever Made*, he is presumably referring to the distance covered during the March.

The distance travelled by the Captain Scott party is not exactly known, since the party did not at many instances measure the exact longitude, as for example indicated in Tab. 9.1. For that reason, exact estimation of travelled distance is impossible. However, with fair accuracy, one can estimate that the Captain Scott party covered about 1360 geographical miles. Comparing this with the similar march made by Lt Shackleton during the *Nimrod Expedition*, one finds that he did about 1360 geographical miles. However, Lt Shackleton's figure is the direct distance travelled and does not include distances travelled in relay work and back marches. By adding these distances, one can get a total of about 1525 geographical miles! Thus, Lt Shackleton and his party travelled a total distance that was about 12% greater than the Captain Scott party. The conclusion of which explorer has made the Greatest March in miles is palpable.

After the *Nimrod Expedition*, Lt Shackleton planned the *Imperial Trans-Antarctic Expedition* (1914–17), also known as the *Endurance Expedition*. This time, he was more realistic in his plans and assumed that[70]

> The dogs gave promise, after training [the dogs, the people or both?], of being able to cover fifteen to twenty miles a day with loaded sledges. The trans-continental journey, at this rate, should be accomplished in 120 days unless some unforeseen obstacle intervened.

The shortest distance from the starting point at Vahsel Bay (–77.816667, –35.116667) to Hut Point *via* the South Pole is about 1486 geographical miles. It appears that an even greater march was planned, but instead many other great exploratory records were subsequently set.

9.6. Synopsis

In this chapter, I investigated the question of the logistics of Captain Scott's *Southern Journey*. I was especially concerned with the logistics of the outward journey of the Captain Scott party, and the relationship of daily sledging mileage and food/fuel ra-

tions allotted according to the original (assumed) 144-days schedule. The reason behind my approach was simple. If the Captain Scott party was accelerating relative to the schedule, the party should arrive more frequently at depôts placed under the assumption of the 144-days schedule.

I have shown that Captain Scott was unjustly criticized for his lack of contingency plans. His plan to account for unforeseen events was based (subtly) on his original assumption of a low sledging velocity within the 144-days schedule. Thus by increasing/decreasing sledging velocity, he could decrease/increase, although at extra energy expenditure/saving, total food/fuel consumption over the course of the journey.

In a critical moment in January 1912 on the Antarctic Plateau, when the party apparently would be short of food/fuel rations within the 144-days schedule, Captain Scott took the risky decision to increase sledging velocity to make up for insufficient rations and capture the Pole.

After Captain Scott turned back from the South Pole, his party was gaining distance (time) over the 144-days schedule day after day. Thus, its frequency of visiting depôts was increasing and they had a surplus of food/fuel. The death of Edgar Evans and the pony meat collected by the party at Shambles Camp further increased daily food/fuel allowances. Additionally, the death of Captain Oates allowed the party to consume additional rations.

Simple analyses of fuel allotted to the Captain Scott party at the Barrier stage shows that his successive references of fuel shortages from Feb. 24th, 1912 onwards are not supported by the respective calculations. Thus, the conclusion that Captain Scott lied about fuel shortages was presented.

It appears that these apparent fuel shortages were a prelude to further false claims by Captain Scott of the *Extreme Cold Snap* and the *Never Ending Gale*, as discussed in the previous chapters.

I also presented a number of scenarios that Captain Scott could analyze while thinking about collecting specimens. I showed that the best time for collecting samples was during the Beardmore Glacier ascent. It could ensure a minimum sledging burden, as well as increase the probability that the specimens will end up at Hut Point.

I also presented an analysis of the role of the geological specimen's collected by Captain Scott's party in the development of the continental drift hypothesis. On the contrary to various unfounded and unsupported claims, Captain Scott's specimens that contained imprints of *Glossopteris indica* did not directly or indirectly contributed to the formulation of the continental drift hypothesis by Alfred Wegener. The evidence of Antarctica being a part of Gondwana as we know it came from the summary of results of all expeditions which visited southern waters and the Antarctic continent.

Finally, and what I think is the main result of the current chapter, is that I found evidence that Captain Scott, during the return leg from the Pole and already at the edge of the Beardmore Glacier, contemplated and consequently presented deceitful comments about food and fuel shortages.

9.7. Appendix to Section 9.3

There are a number of issues related to the geological specimens collected by the Captain Scott party. These issues are:

- Reasons why the party collected specimens,
- Reasons why the party was dragging 35 ℔ of specimens,
- Real and alleged scientific significance of the specimens,
- Portraying Captain Scott as a scientist.

The first two issues mentioned above are related to Captain Scott's collection of geological specimens, which I examined in section 9.3. In this Appendix, I will look in more detail at the two remaining issues.

To understand the related issues, one has to observe that at the turn of the twentieth century, as compared with the present day, only a few researchers were working on the given subjects.[71] Additionally, scholarly papers were less frequent, though each publication contained more scientific weight than modern, usually fragmented research publications. In Chapter 1, by showing in Tab. 1.1 the summary of how delayed publications of meteorological research from most Antarctic expeditions were, I argued that the scholarly and public interest in these field results was close to nothing.

In 2012, from Jan. 20th through Sep. 2nd, the Natural History Museum in London organized an exhibition under the running title *Scott's Last Expedition*. Over the Internet, the exhibition was announced by a short article without apparent authorship, under the descriptive title *Scott's South Pole Expedition Science Legacy*.[72] In this note, one can read (including the bold highlighted words) that

> The Terra Nova expedition had the **largest team of scientists** that had ever visited the Antarctic continent. The team of **12 scientists** included 2 biologists, 3 geologists and 1 meteorologist.

Indeed, by consulting Captain Scott's journal[73] and the respective Tab. 10.4 in Chapter 10 derived from it, one finds that altogether under the heading of Shore Parties, the following groups are selected: Officers, Scientific Staff, and Men. Under the Scientific Staff heading, 12 persons are listed – Wilson, Simpson, Taylor, Nelson, Debenham, Wright, Priestley, Ponting, Meares, Day, Cherry-Garrard and Gran. However, Ponting (photographer), Meares (dog handler), Day (motor engineer), Cherry-Garrard (assistant zoologist), and Gran (ski expert) were not scientists by a long shot. Arguably, Dr Wilson was not a scientist either. The investigative reader must also understand that the list of the *Terra Nova Expedition* Shore Party was prepared and added to Captain Scott's journals by its editors, Leonard Huxley and Cherry-Garrard. Therefore instead of 12 scientists, the Captain Scott *Terra Nova Expedition* had 1 disputed zoologist (Wilson), 1 biologist (Nelson), 3 geologists (Taylor, Debenham and Priestley), 1 meteorologist (Simpson) and 1 physicist (Wright). Thus, the Natural History Museum's exaggeration, a multiplication of the number of scientists by 1.7–2 times, fits well into previously uncovered exaggerations and overstatements concerning Captain Scott's expedition.

The investigative reader may recall from the previous chapters the great number of exaggerations, overstatements, and simple minded distortions. The author,

from a presumably distinguished institution, the Natural History Museum, further confuses the already confused readers and visitors by using the self-contradictory description that

> The team brought back specimens in crates, jars and bottles, representing over **2,000 different species** of animals and plants, with more than **400 new to science**.
> More than an incredible **40,000 Terra Nova specimens** are looked after at the Museum and they are studied by scientists from all over the world.

The above echoes Sir Ranulph's humorous and pathetic comment that[74]

> Much of the analysis of *Discovery's* work took decades to complete and it wasn't until the 1960s [*sic*], when that analysis was finally completed [*sic*], that its overall success [*sic*] set against any other polar expedition of the early twentieth century, became self-evident [*sic*].

Sir Ranulph's counterfactual is suggesting that the results of Captain Scott's *Terra Nova Expedition* were of lesser importance and less numerous. Indeed, the Natural History Museum does not confirm Sir Ranulph's judgment, and instead it rather confirms that the *Terra Nova* specimens even now "are studied by scientists from all over the world".

The author of the Natural History Museum web note, as well as Sir Ranulph, make nonsensical remarks. Does anyone believe in these figures? Since 400 species were new to science, some 40,000 specimens of Captain Scott's expedition specimens "are [*sic*] studied by scientists from all over the world" some 100 years after they have been collected. Of course, such a statement makes no distinction between the specimens collected in Antarctica and the specimens collected by the *Terra Nova*'s crew during its travels, and as such is extremely misleading.

In 1735, the first edition of Carl Linnaeus' *Systema Naturae* contained an eleven-page (11) classification of species of plants and animals. However, the twelfth edition (1766–1768) contained about 2,400 pages of expanded classification of a new species of the natural world. Thus, within 31 years of work, Linnaeus was able to increase the volume of his classification by more than 200 times. This clearly indicates that the Natural History Museum figures are simple rubbish. It does not take a year to classify 4 new species.

Ignoring the ridiculous comments and lies of the London Natural History Museum web note that during the winter trip of Dr Wilson, Lt Bowers and Cherry-Garrard to Cape Crozier to collect penguin eggs "it was reported that their teeth cracked! [to my knowledge only Cherry-Garrard's teeth cracked –KS]" let me just point out that "Their eggs did eventually end up with a specialist at Edinburgh University after many months spent misplaced by indifferent professors at the London Natural History Museum".[75]

Let me continue with the issue of the importance of geological specimens. The related expedition work was clearly described by senior geologist Griffith Taylor[76]

> Captain Scott's last expedition was numerically strong in geologists, who were all to some degree associated with the geological schools of Cambridge or Sydney. Thus in the Northern Party was Raymond Priestley, primarily

> from Bristol (whence he had accompanied Shackleton in 1907) but later of Sydney and Cambridge. In the Ross Island Region were Frank Debenham of Sydney (and later of Cambridge) and myself who was appointed from Cambridge. Charles Wright (of Toronto and Cambridge) specialized in the physical aspect of the ice problems and was a member of the Polar Supporting Party. Dr. Wilson (also of Cambridge) was a keen observer of physiographic features, and made many sketches of the land forms on his last journey. To him also we owe the unique Gondwana Land Flora from the head of the Beardmore Glacier. Our leader was an amateur geologist [*sic*] with great critical powers, as I have described elsewhere, and his paper on the structure of the Ross Ice Barrier (recently published by the Royal Geographical Society) shows that he had given much thought to some of the most important questions in Antarctic geology.

Indeed, a fine group of geologists. However, not the first geologists to visit the sub-Antarctic islands and the continent itself. It is very rare that great discoveries in science come as a single-minded discovery, without a number of past (more or less successful) approximations and accounts. This observation is universal and is thus also applicable to paleobotanical research activities in Antarctica.

In the nineteenth century, scientific discovery through exploration reached its golden age and is associated with scholarly explorers like Friedrich W. H. Alexander von Humboldt (1769–1859), Charles Robert Darwin (1809–1882), or expeditions like the *Challenger Expedition* (1872–76).

In 1901, Arnold E. Ortmann reviewed up to date theories of the origin of the Antarctic faunas and floras. Here is his summary[77]

I. Theories assuming a land connection between the respective parts.

> This general idea was first expressed by Hooker (1847). It has been accepted by all subsequent writers except Wallace.

- 1.1. The land bridge is placed across the present Antarctic continent, first by Ruetirneyer (1867) and by Hutton (1873). It was accepted by Von Ibering, Forbes, Hedley, Osborn.
- 1.2. Forbes constructs his immense Antarctica (1893).
- 1.3. Hedley restricts it to reasonable limits (1895).
- 1.4. Osborn takes an intermediate standpoint (1900)
- 2. Gill constructs his Eogoea, a continent uniting Africa, South America, and Australia, but leaving out Antarctica (1875).
- 3. Hutton connects Australia and South America by his mid-Pacific continent, but denies the existence of an Antarctic connection

II. Theory of Wallace (1876) rejecting any land connections whatever between the respective parts.

I cited Ortmann's summary, not for our further study, but to only show that a good number of various scholars, long before Alfred Wegener in January 1912 presented his continental drift hypothesis, were proposing land connections between the continents. The theories mentioned above were highly speculative, and based on very limited field observations. But this did not last for long, for year after year, sealers, whalers, and explorers were bringing back more and more paleobotanical specimens

and samples. The following major pre-*Terra Nova* expeditions reported on many scientific aspects[78] of Antarctica:

1892–1893 – Carl Anton Larsen led the first Norwegian expedition to Antarctica,
1892–1893 – Dundee Whaling Expedition discovered Dundee Island,
1893–1894 – Carl Anton Larsen led the second Norwegian expedition to Antarctica,
1893–1895 – Henryk Bull, Carstens Borchgrevink and Alexander von Tunzelmann,
1897–1899 – Belgian Antarctic Expedition – led by Adrien de Gerlache,
1898–1900 – Southern Cross Expedition – led by Carsten Borchgrevink,
1901–1904 – Discovery Expedition – led by Robert Falcon Scott,
1901–1903 – Gauss expedition – led by Erich von Drygalski,
1901–1903 – Swedish Antarctic Expedition – led by Otto Nordenskjöld and Carl Anton Larsen,
1902–1904 – Scottish National Antarctic Expedition – led by William Speirs Bruce,
1903–1905 – Third French Antarctic Expedition – led by Jean-Baptiste Charcot,
1907–1909 – Nimrod Expedition – led by Lt Shackleton,
1908–1910 – Fourth French Antarctic Expedition – led by Jean-Baptiste Charcot.

It appears that the results of the above-listed expeditions were sufficient to include the Antarctic continent in a general theory of continental drift. The theory, or back then the hypothesis, of continental drift has many fathers, and was formulated in a number of rudimentary descriptions over many years. Unquestionably, it was Alfred Wegener who on Jan. 6th, 1912 presented to the German Geological Society the most comprehensive description of continental drift.[79] He theorized that the continents had once formed a single landmass, before breaking apart and slowly drifting to their present day temporary locations. However, he did not explain why the originally formed Gondwana was one land mass instead of a group of continents.

Dr Wegener, to present his hypothesis, argued that a similarity of:

1. Plant fossils,
2. Animal fossils,
3. Present day animals,
4. Glacial sediments,
5. *Etc.*

found at today's continents is prime evidence that in the past, one landmass called Gondwana must have existed. Of course, the just mentioned evidence was not found or present on every inch of each continent, but rather sparsely distributed. Despite the fact that Dr Wegener's hypothesis was initially met on various grounds with severe skepticism from geologists, his original work was developed without contribution from Captain Scott's *Terra Nova Expedition*.

A *Catalogue of the Fossil Plants of the Glossopteris* printed in 1905 by the Natural History Museum as depicted on Fig. 9.10 shows that the time distribution of fossil plants of the *Glossopteris* was already known. Although I cannot find a precise land area where the respective fossils have been detected prior to 1905, my rough estimation is that it constituted about $1/5$ of all land mass. This knowledge, supported by other arguments, was sufficient for Dr Wegener to formulate the continental drift hypothesis in January 1912.

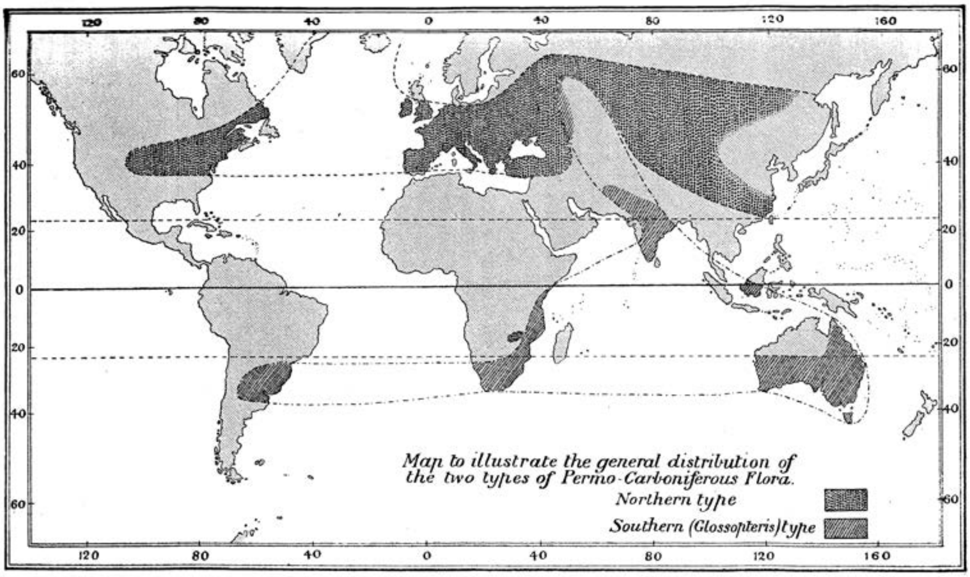


Figure 9.11. A map depicting the general distribution of the two types (Northern and Southern (*Glossopteris*) type) of Perino-Carboniferous flora.[1]

[1] E. A. Newell Arber, *Catalogue of the Fossil Plants of the Glossopteris Flora in the Department of Geology*, British Museum (Natural History), London, 1905, *cf.* p. xix.

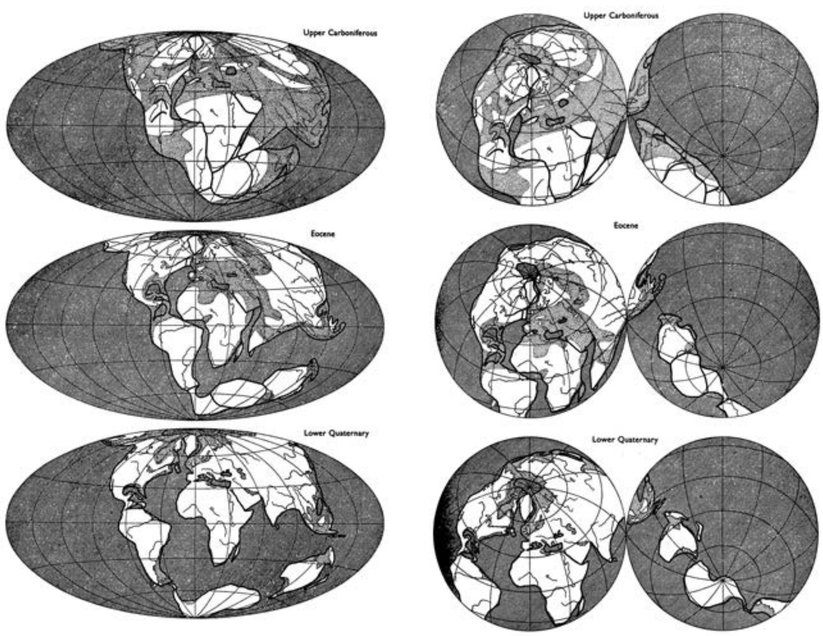


Figure 9.12. A map of continental drift proposed by Dr Wegener.[1]

[1] A. Wegener, *Die Entstehung der Kontinente und Ozeane*, Vieweg & Sohn Akt.-Ges., Germany, 1929, *cf.* p. 13.

By that time, very little was known about the coastline of Antarctica. However, it was adequate for Dr Wegener to attach this little-known continent to the general map of Gondwana, and to depict it on the map of drifting continents. Dr Wegener's map is reproduced on Fig. 9.11. The careful reader can very easily observe on these maps a gradual drift of Antarctica into its present location.

Much more on these related issues can be found in Dr Frankel's account *The Continental Drift Controversy: Wegener and the Early Debate*, as well as in *Ending in Ice: Alfred Wegener's Revolutionary Idea and Tragic Expedition*.[80]

Chapter 10

Silent Mutiny at Cape Evans

'If the depôt [of dog food – KS] *had been laid'*
Shaw asked him
'Would you have gone on?'
'Of course,' Cherry said

Apsley Cherry-Garrard[1]

Taking into consideration the weather and temperatures and the time of the year, and the hopelessness of finding the party [Captain Scott – KS] *except at any definite point like a depôt, I decided to return from here.*
At this date [Mar. 30th, 1912 – KS] *in my own mind I was morally certain that the party had perished.*

Edward L. Atkinson[2]

I can now [Feb. 20th, 1913 – KS] *form some idea of what happened to Scott's party, but there has not been a word as to what was done to succour him, except some wild words questioning whether all possible had been done. I know nothing more was possible, but I am very impatient for fuller news which cannot, however, arrive before 1 March.*

George C. Simpson[3]

Captain Scott and his companions' fight against nature, and his personal weaknesses are well known and have been told with great eloquence many times, but without any in-depth analysis. In many books, Captain Scott's story ends in March 1912. In a recent account of Captain Scott's life, British author David Crane starts his book in 1913 with the St. Paul's Cathedral services, and ends in March 1912 with whispering vortices in the galleries of St. Paul's Cathedral[4] – Oh! England! Oh! England! What men have done for thee.[5]

However, by thinking not in Captain Scott's terms, but from the perspective of the *Terra Nova Expedition*, one cannot ignore side events in which Captain Scott did not directly participate and/or describe. These include events related to auxiliary parties, as well as events at Cape Evans after the departure of the South Pole parties in November 1911.

While studying documents and accounts of other Captain Scott members of the expedition, one inevitably gets the feeling that these accounts contain many contradictory and counterfactual descriptions of events in early 1912.

In Chapter 2, where I presented an analysis of the weather account during the *Terra Nova Expedition*, I described there the First Relief Party's (Cherry-Garrard) and the Second Relief Party's (Dr Atkinson) journey in late February and March 1912. Using simple math and counting the various parties' velocities, I concluded that these relief attempts were phony actions, rather than real relief missions.

This original finding prompted me to look much more into the actions of fellow explorers at Cape Evans. Up to now, my analysis was guided by a *cæteris paribus* assumption. The assumption was that, in spite of different methods, means, and human effort, the Captain Scott party was able to reach the South Pole and was capable of returning safely to the base camp at Cape Evans (Hut Point). This left the weather, understood as a combination of temperature and wind speed, as the only *independent* variable of which analyses I presented in the previous chapters.

The use of the *cæteris paribus* assumption is particularly useful in studies of complex systems where simultaneousness analysis of all possible variables is difficult or useless, if not impossible. It enables one to stay focused, and not to pointlessly ramble on about Cherry-Garrard's "ifs"[6]

> Of course the whole business simply bristles with "ifs": If Scott had taken dogs and succeeded in getting them up the Beardmore: if we had not lost those ponies on the Depôt Journey: if the dogs had not been taken so far and the One Ton Depôt had been laid: if a pony and some extra oil had been depôted on the Barrier: if a four man party had been taken to the Pole: if I had disobeyed my instructions and gone on from One Ton, killing dogs as necessary: or even if I had just gone on a few miles and left some food and fuel under a flag upon a cairn: if they had been first at the Pole: if it had been any other season but that … But always the bare fact remains that Scott could not have travelled from McMurdo Sound to the Pole faster than he did except with dogs; all the king's horses and all the king's men could not have done it. Why, then, says the practical man, did we go to McMurdo Sound instead of to the Bay of Whales? Because we gained that continuity of scientific observation which is so important in this work: and because the Sound was the starting-point for continuing the exploration of the only ascertained route to the Pole, via the Beardmore Glacier.

However, since Cherry-Garrard was not "the practical man," his "ifs" are false concerns. Indeed, his veracity and pondering about the difference in selection at McMurdo Sound versus the Bay of Whales is a vain discussion, with a self-invented question. A practical man would rather ask why a small party, for the sake of "continuity of scientific observation," was not deployed at McMurdo Sound and the main effort directed to landing at the Bay of Whales? The same practical man will also ask why he, Cherry-Garrard, did not learn how to navigate, how to use a compass, how to ski, how to drive a dog sledge, how to calculate the time when the Captain Scott party was expected to reach One Ton Depôt, *etc*.

An even more practical man would ask how Cherry-Garrard's party would proceed from the Bay of Whales? Should they find a new route to the Pole, or cross the Barrier and follow the Beardmore Glacier route? The distance difference between Cape Evans and the Bay of Whales to the Beardmore Glacier is about 13 miles. Is

Cherry-Garrard suggesting that these 13 miles were worth risking danger to his team due to unstable conditions at the Bay of Whales?

In reality, by formulating all of these presumptions, Cherry-Garrard derails the reader's attention from "practical" thinking. I have shown in Chapter 2 that by using elementary math of adding distances and food rations, Cherry-Garrard could have met and relieved the Captain Scott party. In my calculations, no "dog eat dog" assumption was present. However, Cherry-Garrard's presumption that he could not kill the dogs formulates an excuse which an unpractical man (reader) takes for granted. Equally scary is Cherry-Garrard's mythical appeal to science. To what "continuity of scientific observation" is he referring? Why, specifically, does anyone need continuity of scientific observation?

On the contrary to Cherry-Garrard's expounding in the current chapter and remembering my previous results, I will re-analyze events and the actions of the Captain Scott crew – those who were left or those who returned to base camp at Cape Evans/Hut Point. I will assume that for the actions of these explorers, the only independent variables were distance and time.

These independent variables must be understood as distance and time variables directly dependent upon actions of people involved in crossing certain distances, and/or taking these actions at certain times (dates).

Additionally, whatever comment will be made, it results from the reality that the *Terra Nova Expedition* was not a leisurely undertaking. It was indeed a life-threatening expedition. Every human action during the expedition had its own potential to end tragically. No one was on a *sinecure* assignment.

10.1. George C. Simpson

Since in this book I was concerned with meteorology of the *Terra Nova Expedition*, at many instances I discussed the work of Dr Simpson, and there is no need to review it here. In this chapter, I am concerned with Dr Simpson's role in the events at Cape Evans after Captain Scott's departure to the South Pole.

Captain Scott, in a similar fashion as in the case of other expeditions with important personnel, issued written instructions to Dr Simpson. The transcript of these original instructions is given in the Appendix to the current chapter. Since I will interweave these instructions with factual events in 1912, the reader is advised to consult these instructions before reading further.

The most important and far-reaching instruction given by Captain Scott to Dr Simpson was that he was *nominated to be in charge* of the Cape Evans Station. Thus, the line of command at Cape Evans was clearly established by the commander, "the owner" of the expedition, Captain Robert F. Scott.

Although the expedition received support from a government grant and was backed in various ways by Admiralty and the Royal Geographical Society, the *Terra Nova Expedition* was a *private venture* – a Captain Scott enterprise. From Captain Scott's background, we know he certainly was inclined to use naval discipline and drill, but the expedition remained a private one. Therefore, if Captain Scott named one for a given post, he and only he could discharge the nominated person from his

duty, provided that the nominee accepted the post and was not dead, invalidated, or did not mutiny afterwards.

Therefore, from Nov. 3rd, 1911, the actual Captain Scott departure from Hut Point, Dr George Simpson was in command. Since he was, according to Captain Scott "in charge [*sic*] of the Cape Evans Station," he was in charge of all actions undertaken by fellow explorers. To my knowledge, at no time and at no instance after that date did Captain Scott in writing or in verbal orders discharge Dr Simpson from his command.

From Captain Scott's *Instructions to Dr Simpson* (see subsection 10.8.3), one can readily conclude that Captain Scott believed at least in October 1911, that Dr Simpson was his most trustworthy fellow to be responsible for making sure that the actions of all men at Cape Evans would be expected to support the Southern Party

> I think you are fully aware of my plans and wishes, beyond their expression in the various statements you have seen, and that it is needless to go further with written explanations.

Since the main party left on Nov. 1st, Dr Simpson continued his meteorological observations at Cape Evans.

On Nov. 24th, 1911 (latitude –81.2333, 223 miles from Hut Point), the party of two, Bernard Day and Frederick Hooper, were ordered by Captain Scott to return. The only reason of their return was pertaining to previous orders to communicate with Dr Simpson[7]

> My dear Simpson. This goes with Day and Hooper now returning. We are making fair progress and the ponies doing fairly well. I hope we shall get through to the glacier without difficulty, but to make sure I am carrying the dog teams further than I intended at first – the teams may be late in returning, unfit for further work or non-existent. So don't forget that the [supplies] must be got to One Ton Camp, Lat 79½ somehow.

Captain Scott's orders were carried out and the Day party returned to Hut Point. It is clear that since the Dog Sledging Party (Meares and Dmitrii) had not yet returned, someone had to carry Captain Scott's orders issued by him to Meares. Thus to prepare for this event, Captain Scott wrote a set of instructions for Cecil Meares' dog team(s) that (see also Appendix to the current chapter)

> At some time during this month or early in January you should make your second journey to One Ton Camp and leave there: 5 units X.S. ration, 3 cases of biscuit, 5 gallons of oil. As much dog food as you can conveniently carry (for third journey). This depot should be laid not later than January 19, in case of rapid return of first unit of Southern Party.

now was directed to Day and Hooper, and of course indirectly to Dr Simpson, who was in charge at Cape Evans. Captain Scott's written orders to Meares were clearly stated.

What is unclear is that since the food and oil were intended for three returning parties, why did Captain Scott ordered only 5 units to be additionally deposited at One Ton Camp (Depôt)? These returning parties were the First, Second and Main Parties, altogether $3 \times 4 = 12$ men.

However, why did Captain Scott give orders to re-supply One Ton Depôt with exactly 5 units X.S. for three returning parties? If each party was taking an equal share, it would mean taking 1⅔ X.S. ration per party. Since the actual (*via* Corner Camp) distance between One Ton Depôt and Cape Evans is 118 miles, the party(s) would need 11⅔ sledging days to cover the distance with an initially assumed velocity of 10.1 miles/day. Because 1 unit was assumed by Captain Scott to last (to be sufficient) for one week consumption by a 4 man party, one can see that 5 X.S. units were the exact value which was to be consumed by all three returning parties taking their share of 1⅔ X.S (1⅔ + 1⅔ + 1⅔ = 5)!

Following Captain Scott's written orders issued to Meares and directly to Dr Simpson, he, on Dec. 26th, 1911, dispatched Day's Depôt Party (Day, Nelson, Clissold and Hooper). However, something expected but dangerous happened. According to Cherry-Garrard, the party had[8]

> taken out three of the five [*sic*] X.S. rations for the returning parties. The weights of the man-hauling party did not allow [*sic*] for the transport of the remaining two X.S. rations, nor for any [*sic*] of the dog-food.

I did say above that transporting only three X.S. rations instead of the five was expected. Actually, it was a death sentence given to Captain Scott and his party by Dr Simpson. How did Dr Simpson expect that 3 X.S. units would sustain the returning parties? If every party took one out of three transported rations, it would mean that at least the last leg of their journey would have been without food. Was Dr Simpson thinking that after 1400 miles, Captain Scott would endure and survive starvation during the last week of their journey? The words written by Dr Simpson in his Preface to the first volume of the *Terra Nova Expedition* take on a different meaning[9]

> Over and over again as point after point was cleared up I have longed to be able to show the result to Captain Scott, for there was hardly a problem of Antarctic meteorology which we had not discussed together. His interest in every scientific problem with which the expedition was concerned was intense and I do not think that I have ever met a man who had the true scientific spirit so utterly unalloyed. To most of us who have given our lives to science our investigations are frequently tinged with an unscientific desire to increase our scientific reputations, but with him, it was the added knowledge alone which gave pleasure. He was constantly looking forward to the successful completion of the journey to the Pole, the exact value of which was perfectly clear to him, in order that he might spend his remaining time in the Antarctic in opening up new country and making new discoveries.

If Captain Scott somehow returned from his journey, he would certainly ask Dr Simpson, why only three X.S. rations were sent to re-supply One Ton Depôt? Dr Simpson might have answered in the same way as Cherry-Garrard did, or blamed Captain Scott's orders[10]

> The weights of the man-hauling party did not allow [*sic*] for the transport of the remaining two X.S. rations, nor for any [*sic*] of the dog-food.

However, Captain Scott's knowledge would not permit Cherry-Garrard to lie and tell stories. The reasons are indeed simple. While planning the South Pole journey,

Captain Scott used weekly measures for sledged distance and weekly food/fuel supply. The weekly sledging food supply was called the unit for four men and consisted[11]

> Henceforward our full ration will be 16 oz. biscuit, 12 oz. pemmican, 2 oz. butter, 0.57 oz. cocoa, 3.0 oz. sugar and 0.86 oz. tea. This is the Summit ration, total 34.43 oz. [2.15 ℔]

Therefore, the weight of *one* unit was about 60.2 ℔ (4 × 7 × 2.15 ℔). The crucial question for Captain Scott was: what is the maximum range of a *self-sustainable* sledging party of 4 men? In vain one would look in the *Terra Nova Expedition* documents to find an answer to this fundamental question. Various parties at various times carried a range of loads, varying from 180 ℔ a man (Western Party) to 250 ℔ a man for the Captain Scott parties ascending the Beardmore Glacier. Without going into analysis for the reasons behind different loads hauled by various parties, let us stay with the most representative figure, 250 ℔ a man dragged by Captain Scott up the Beardmore. The figure of 250 ℔ a man is the most representative due to logistical reasons that in order for the food rations to suffice for the entire journey, Captain Scott was forced to drag this amount during the two weeks (theoretical) ascent of the Beardmore Glacier. The little Tab. 10.1 summarizes food/fuel theoretical requirements.

Table 10.1. Names of the party and food units used during of the Barrier stage (see also Fig. 9.8).

Party Name	Units Used	Duration
Captain Scott	3 × 4	6 × 2 weeks
Second Return	2 × 4	4 × 2 weeks
First Return	1 × 4	2 × 2 weeks

Thus, the most difficult part of the journey was pushing forward uphill and between the crevices of the glacier, and in respect of the many additional sledging weeks *each* party had to drag at the beginning 7-8 X.S. units. It is, therefore, fair to assume that the lower limit of self-sustained sledging is about 250 ℔ a man. Because it would take two weeks to ascend and two weeks to descend the Beardmore Glacier, the parties were capable of delivering at least four (4) units to the Upper Glacier Depôt.

Exactly the same time is required to sledge from Hut Point to One Ton Depôt. Therefore, Day's party, not having to man haul up the hill, could easily deliver 5 X.S. units to be used by all three returning parties, including the Captain Scott party. None of that happened, and Day's Depôt Party, which left Hut Point on Dec. 26th, 1911, returned on Jan. 21st, 1912. Altogether, the party sledged for 27 long days with a *leisurely* velocity $\upsilon \approx 2 \times 118$ miles/27 days = 8.7 miles/day. Comparing Day's party sledging velocity with the respective velocities of the various Captain Scott parties as depicted on Fig. 2.3, one can note its *very* low value.

I could not establish the exact date of return of Day's and Hooper party from the southern journey. Let us assume however that departure of Day's Depôt Party on Dec. 26th, 1911 was the earliest possible. If so, Dr Simpson could easily calculate that the party, by sledging with a velocity of 10.1 miles/day and travelling twice to

One Ton Depôt, could complete Captain Scott's task in about 47 days. However, if Day's Depôt Party was sledging with 14.8 miles/day, the velocity achieved by the Captain Scott party during the return stage over the Antarctic Plateau (see Fig. 2.3) of about 32 days would be required, and by Jan. 26th, 1912 Captain Scott's order would be completed. Coincidently, the First Return Party returned to Hut Point on exactly the same date.

Alternatively, Dr Simpson could order his party to relay sledged goods. Alternatively to that, Dr Simpson could send an additional party to the depôt at Corner Camp, or further south along the expected Captain Scott return route.

Before and well after these events, Dr Simpson was able to make lengthy scientific speculations and analyses, but at this particular instance he was in charge and despite the importance of delivering food for the returning parties, Dr Simpson was sitting still at Cape Evans.

The investigative and careful reader, after re-reading the orders to Meares, could object to the necessity of delivering 5 X.S. rations since Captain Scott also gave orders to Meares that

> At all hazards [*sic*] three X.S. units of provision must be got to One Ton Camp by the date named, and if the dogs are unable to perform this service, a man party must be organised.

Captain Scott's order is indeed strange. Was Captain Scott correct or mistaken by assuming that only three X.S. units of provisions would be sufficient for the three parties to sledge back from One Ton Depôt? Three food units meant one unit per party during sledging the 118 miles to Hut Point. If the unit was supposed to last for one week for a 4 man party[12], it would mean that Captain Scott was assuming that each party will sledge the last leg of the journey at 16.9 miles/day – a rather difficult man-hauling velocity, especially after the *long* journey to the South Pole. Alternatively, the parties could go on a slower (realistic) pace but on reduced food rations. Yet again, rather unworkable.

It is uncertain what situation related to food deposited at One Ton Depôt the First Return Party encountered. However, the situation of the Second Return Party at One Ton Depôt was shortly described by Lashly[13]

> 9th February 1912.
>
> A very fine day and quite warm. Reached the depôt [One Ton Depôt] at 5.5 p.m. and we all had a good feed of oatmeal. Oh, what a God-send to get a change of food! We have taken enough food for 9 days, which if we still keep up our present rate of progress it ought to take us in to Hut Point.

If the First Return Party has taken its share of food (1⅔ unit) in order to return to Hut Point, then from Lashly's description one can calculate that they had taken just over 1 unit (1.07 unit = 9 + 1 = 10 days rations for 3 men). Therefore out of 3 units, about 2⅔ units were taken by the returning parties and only about ⅓ unit of food was waiting for the returning Captain Scott party!

Since Dr Simpson was in charge of Cape Evans, one immediately asks where was he? On one hand, he knew about Captain Scott's orders, and on the other hand he knew the actual amount of food deposited by Day's Depôt Party, and he knew (after

debriefing the party) how much food was left or taken. The mathematics of the food units was elementary.

Why did no one mention that no (or too little) food would be left for the Captain Scott party if only three units had been deposited? Why has no one considered that if the Captain Scott party would for an unspecified reason return before the planned date, then they would find almost no food at One Ton Depôt?

For many authors and thus the readers, reaching the One Ton Depôt was salvation for Captain Scott. However, the question of survival arises if there was going to be no food and fuel at One Ton Depôt.

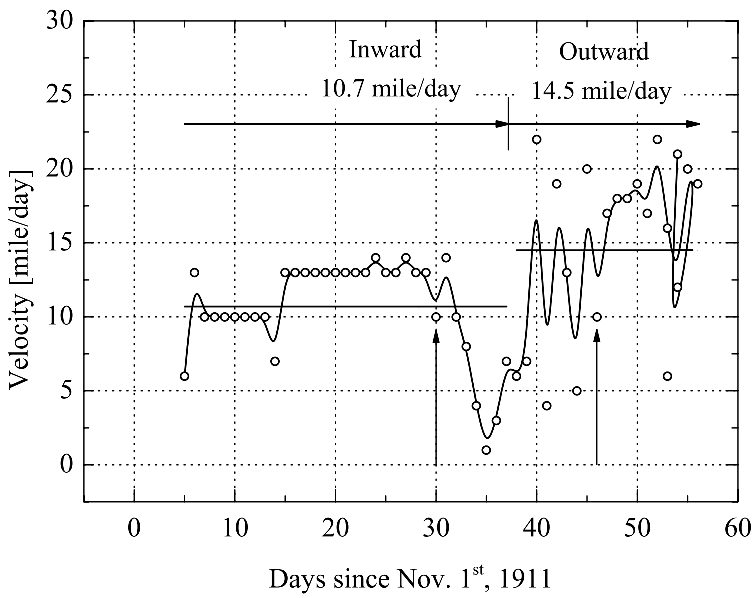


Figure 10.1. Cecil Meares' dog sledging velocity during his journey in support of Captain Scott's South Pole attempt. The ○ represent actual data[1] and the solid line is the B-spline.

[1] George C. Simpson, *Meteorology*, Vol. III, *Tables*, Harrison and Sons, Ltd., London, 1923.

10.2. Cecil H. Meares

Very little is known about the life of Cecil Henry Meares, who was responsible for purchasing dogs in Siberia for the *Terra Nova Expedition*. He, along with Dmitrii Girev, was an experienced dog driver capable of competing with the Captain Amundsen team. However, as Captain Scott observed during depôt journeys in Feb. 22nd, 1911, and contrary to Captain Amundsen's primary mode of dog sledging[14]

> Meares is excellent to a point, but ignorant of the conditions here. One thing is certain, the dogs will never continue to drag heavy loads with men sitting on the sledges; we must all learn to run with the teams and the Russian custom must be dropped. Meares, I think, rather imagined himself racing to the Pole and back on a dog sledge. This journey has opened his eyes a good deal.

Apparently, Meares stuck with his "Russian custom" of dog sledging to the end. However, what was wrong with the Russian custom? How are "the conditions" at the Ross Ice Shelf different from Siberia? Did Inuits in northern Canada and Greenland use a different sledging technique? What would be wrong with racing "to the Pole and back on a dog sledge"?

We know that Captain Scott was rather ignorant of sledging methods in polar exploration. For Captain Scott, the years of British effort in the Arctic were summarized by Sir Francis Leopold McClintock's ill-conceived man-hauling of the sledge. However, the British experience was not unique or universal, and other non-British explorers significantly contributed to more efficient sledging methods.

However, by commenting about Meares' methods, Captain Scott was mentally addressing his rival Captain Amundsen. He was also making empty conjectures that "we must all learn to run with the teams". At no instance after Feb. 22nd, 1911, was Scott bothered with the matter of mastering dog sledging.

More importantly, the real issue was not that Meares was sitting on the sledge. The real issue was that by sitting on the sledge, instead of skiing on the front or side of it, he would diminish (if it was the case) the weight of provisions/items transported by the dog party. Therefore, Captain Scott's comment that by sitting on the sledge Meares was reducing the overall efficiency of transportation would be more appropriate and not aggravating to Meares, who by all means was the right man for his task during the *Terra Nova Expedition*.

Due to lack of data, one cannot study Meares' sledging efficiency on all his journeys. However, in one case, during Captain Scott's South Pole journey, data of sledging efficiency exists and is depicted on Fig. 10.1. On this figure, I depicted two regions where Meares was dog sledging southward and returning back to Hut Point/Cape Evans. One can see that his dog sledging velocity was varying; however, the average inward velocity was 10.7 miles/day. This velocity is almost exactly the same as the respective velocity (10.9 miles/day) of Captain Scott's party as depicted on Fig. 2.3. This confirms the accuracy of the least squares fit of the Captain Scott velocity data, as presented on Fig. 2.3. It also confirms the fact that Captain Scott's velocity was limited to its slowest element, the ponies. It must also be added that Meares, during the inward journey, was dog sledging only a few hours per day and spending the rest of the day sitting idle in the tent.

According to Captain Scott's original orders (see Appendix to this chapter) given (in the form of alternative actions) to Meares, he was

1) Under favorable conditions you should be back at Hut Point by December 19 at latest … At some time during this month or early in January you should make your second journey to One Ton Camp and leave there: 5 units X.S. ration. 3 cases of biscuit. 5 gallons of oil. As much dog food as you can conveniently carry (for third journey). This depot should be laid not later than January 19, in case of rapid return of first unit of Southern Party.
2) Supposing that you have returned to Hut Point by January 13, there will be nothing for you to do on the Southern road for at least three weeks … About the first week of February I should like you to start your third journey to the South, the object being to hasten the return of the third Southern unit and give it a chance to catch the ship. The date of your departure must depend on news

> received from returning units, the extent of the depot of dog food you have been able to leave at One Ton Camp, the state of the dogs, etc.
> Assuming that the ship will have to leave the Sound soon after the middle of March, it looks at present as though you should aim at meeting the returning party about March 1 in Latitude 82 or 82.30 [82°30′S – KS]. If you are then in a position to advance a few short marches or "mark time" for five or six days affecting your object.
> You will carry with you beyond One Ton Camp one X.S. ration, including biscuit and one gallon of paraffin, and of course you will not wait beyond the time when you can safely return on back depots.

It is useful to read Captain Scott's orders to Meares several times. Most importantly, one should observe that Captain Scott was indeed carefully making *contingency* plans for his return.

I already mentioned that because Meares was ordered by Captain Scott to dog-sledge further, it limited or prevented the possibility of his return to Hut Point by Dec. 19th, 1911. The modification of orders in point (1) above were delivered by Day and Hooper to Dr Simpson.

Since Meares returned to Hut Point on Jan. 4th, 1912, it meant that his return velocity was very slow, only about 14.5 miles/day as depicted on Fig. 10.1. Indeed, if one compares Meares' outward velocity of 14.5 miles/day with the dog sledging velocity of Cherry-Garrard/Dmitrii's team (First Relief Party – see section 2.3) varying between 16.9 miles/day to 19.7 miles/day for the outward and return journeys, respectively, one is puzzled by its differences. One is also confused by the comparison of the outward velocity of Meares (14.5 miles/day) with the respective velocities of the First and Second Return Parties (13 and 13.2 miles/day), as well as with Lt Shackleton's velocity of 12.7 miles/day.

Meares' outward journey was covered with a velocity of 14.5 miles/day for 19 days to reach Hut Point. However, if Meares' velocity was close to the Cherry-Garrard/Dmitrii team (19.7 miles/day), he would reach his destination, Hut Point, in 14 days, on Dec. 19th, 1911. That is *exactly* the day mentioned in the first part of Captain Scott's orders to Meares. Provided that the pair of Meares-Dmitrii was far more experienced than Cherry-Garrard-Dmitrii, then achieving the sledging velocity of the former pair was not especially difficult. My assumption of the possible velocity (19.7 miles/day) of Meares dog sledging home was also accepted by Lt Bowers who commented in his journal[15]

> The dogs are wonderfully fit and will rush Meares and Dmitrii back like the wind. I expect he will be nearly back by Christmas, as they will do about thirty miles a day.

However, for some reason, Meares was walking and not trotting the dogs. His return time was *much slower* than the expected pace. On Dec. 27th, 1911, Meares/Dmitrii passed One Ton Depôt and headed toward Corner Camp and Hut Point. Several days later, most probably on New Year's Day, Day's Depôt and Meares' Parties met somewhere close to Corner Camp. I wonder, what went on during this brief encounter. Did they discuss Captain Scott and Dr Simpson's orders given to them? Most probably. If so, Meares learned that the orders given to him by Captain Scott were now being carried

out by Day's Party. He also knew the content of the latest note from Captain Scott to Cape Evans/Hut Point commander Dr Simpson ordering him to not to "forget that the [supplies] must be got to One Ton Camp, Lat 79½ somehow."

Obviously, Day and Meares must have understood that only *a part* of the goods requested by Captain Scott were on the way to One Ton Depôt. The remaining 2 X.S. units (including 3 cases of biscuit, 5 gallons of oil), and an unspecified amount of dog food were still at Hut Point.

Meares and Dmitrii arrived at Hut Point on Jan. 4th, 1912, and it was the time for important decisions to made by Dr Simpson, especially because in the note delivered by Meares stated that "the [supplies] must be got to One Ton Camp, Lat 79½ somehow."

Captain Scott's "somehow" comment gives room for speculation. Was Captain Scott sure or not how the requested supplies must be delivered? I think that Captain Scott gave free reign to Dr Simpson to judge how to handle the supplies transportation.

Because of that, and because of Dr Simpson's earlier decisions of sending with Day's Depôt Party *only* 3 X.S. units and not sending 2 X.S. additional units (and 3 cases of biscuit, 5 gallons of oil) and unspecified amounts of dog food, he had to think over how to manage the situation. What options were at his disposal? Did he reflect and figure out that the Day's Depôt Party carried just a portion of the requested supplies.

As the commander of Cape Evans, Dr Simpson could:

- Dispatch the next men-sledging party,
- Dispatch dog sledging party of Meares/Dmitrii.

The next man-sledging party which could be dispatched by Dr Simpson as indicated in Tab. 10.2 could be Dr Simpson, Ponting and Anton. This party could carry the remaining load of 2 X.S., and thus *fully* re-supply One Ton Depôt with food for the parties, as ordered by Captain Scott.

Dr Simpson could have estimated that he would be back to Hut Point/Cape Evans in about 10 days after departure. This estimation is based on the assumption that while sledging south his party would meet Day's Party, thus permitting Dr Simpson to return to home base after having Day's Party relay the 2 X.S. rations to One Ton Depôt. After returning, Dr Simpson could order Meares to load the dog food and dog-sledge to One Ton Depôt and beyond to Captain Scott's party.

None of the above happened. Was the commander of Cape Evans Dr Simpson sitting still? Not exactly, he was continuing meteorological observations.

On Jan. 21st, 1912, Day's Party including Day, Hooper, Nelson, and Clissold returned, and 9 out of a total of 25 explorers of *Terra Nova Expedition* were at the home base. Why a mere ⅓ of the present expedition personnel could not launch a sledging party in whatever personnel configuration to re-supply One Ton Depôt, and thus follow Captain Scott's orders is indeed strange. Their lack of action is indeed extraordinary.

What puzzles one the most is that no attempt or lasting analysis of the pros and cons was made by Dr Simpson to sledge dog food to One Ton Depôt. The purpose of dog food storage at One Ton Depôt was clear, and evident from written orders to Meares by Captain Scott who expressed his wishes in the following

Table 10.2. Date dependent list of explorers present at Cape Evans/Hut Point in late 1911 and early 1912.

Dec. 21st 1911	**Jan. 4th 1912**	**Jan. 21st 1912**	**Jan. 26th 1912**	**Feb. 5th 1912**	**Feb. 19th 1912**	**Stayed for 1912/1913 season**
Simpson* Ponting* Anton* Nelson Clissold	Simpson Ponting Anton Nelson Clissold Day Hooper	Simpson Ponting Anton Meares Dmitrii	Simpson Ponting Anton Meares Dmitrii Nelson Clissold Day Hooper	Simpson Ponting Anton Meares Dmitrii Nelson Clissold Day Hooper Atkinson Wright Keohane Cherry-Garrard	Simpson Ponting Anton Meares Dmitrii Nelson Clissold Day Hooper Atkinson Wright Keohane Cherry-Garrard +*Terra Nova* Crew	Dmitrii Nelson Hooper Atkinson Wright Keohane Cherry-Garrard Debenham Gran Lashly Crean Archer Williamson
Day[1] *Hooper* →	*Meares*[2] *Dmitrii* →**	*Nelson*[3] *Clissold* *Day* *Hooper* →	*Atkinson*[4] *Wright* *Keohane* *Cherry-Garrard* →	+*Terra Nova Crew*[5] →	*Taylor*[6] *Debenham* *Gran* *Forde*	
					"Teddy" Evans[7] *Lashly* *Crean*	

* Stayed at Cape Evans until the *Terra Nova*'s departure on Mar. 4th, 1912.
** On Jan. 17th, 1912, Ponting spotted the *Terra Nova*.
1 Day's and Hooper Party: Returning from the Barrier and arriving at Hut Point on Dec. 21st, 1911.
2 Dog Sledge Party: Departed from Hut Point Nov. 5th, 1911, and returned to Hut Point on Jan. 4th, 1912.
3 Day's Depôt Party: Departed from Hut Point on Dec. 26th, 1911, and returned to Hut Point on Jan. 21st, 1912.
4 First Return Party: Departed from Hut Point on Nov. 3rd, 1911, and returned to Hut Point on Jan. 26th, 1912.
5 The *Terra Nova* moored at McMurdo Sound.
6 The Granite Harbour party.
7 Second Return Party: Departed from Hut Point on Nov. 3rd, 1911, and returned to Hut Point/Cape Evans on Jan. 26th/28th, 1912, respectively.

> About the first week of February I should like you to start your third journey to the South, the object being to hasten the return of the third Southern unit and give it a chance to catch the ship. The date of your departure must depend on news received from returning units, the extent of the depot of dog food you have been able to leave at One Ton Camp, the state of the dogs, etc.

However, in mid-January, the chain of incidents was as follows:

1. Because Captain Scott took Meares further south he returned later to Cape Evans and could not carry out the first set of Captain Scott's orders as originally scheduled,
2. For that reason, orders given by Captain Scott to Meares were carried by Dr Simpson and the Cape Evans party,
3. Dr Simpson launched a re-supplying party, but they drug only 3 X.S. units in accordance with Captain Scott's orders,
4. As a result, 2 X.S. units and dog food were not transferred to One Ton Depot,
5. Therefore, Meares in early February could not make his journey as originally scheduled by Scott's orders.

10.3. Edward L. Atkinson

On Jan. 26th, 1912, the First Return Party (see Tab. 10.3) arrived. Its return unleashed an additional chain of events which hardly can be understood without thinking that a tacit mutiny occurred at Cape Evans, and Dr Simpson and Meares did not want to follow simple and written orders from Captain Scott.

Table 10.3. Departure and return dates of parties during Captain Scott's South Pole journey. HP – Hut Point and CE – Cape Evans.

Party Name	Departure	Return to HP/CE
Main Polar	Nov. 3rd, 1911	Did not return
Dog Sledge	Nov. 5th, 1911	Jan. 4th, 1912
Day's and Hooper	Nov. 24th, 1911	Dec. 21st, 1911
Day's Depôt	Dec. 26th, 1911	Jan. 21st, 1912
First Return	Dec. 22nd, 1911	Jan. 26th/28th, 1912
Second Return	Jan. 4th, 1912	Feb. 22nd, 1912
Terra Nova	Dec. 15th, 1911*	Feb. 5th, 1912
First Relief	Feb. 26th, 1912	Mar. 16th, 1912
Second Relief	Mar. 27th, 1912	Apr. 1st, 1912

* Departure from Port Lyttelton (–43.60, 172.72), Christchurch, New Zealand.

Despite Captain Scott's written orders to Dr Simpson and Meares, an array of counterfactuals, misleading, and detracting issues were produced and discussed, either by the explorers themselves or by the authors of various accounts.

The first counterfactual was already mentioned above when it was told by Cherry-Garrard that Day's Party could not drag more than 3 X.S. units. Since Captain Scott's parties in addition to daily consumption could sledge up the Beardmore Glacier a total of 7-8 X.S. units, Cherry-Garrard's account sounds ridiculous.

Table 10.4. The British Antarctic Expedition 1910 (*Terra Nova Expedition*) – the Shore Party (see also section 12.4).[1]

Name	Life-Time	Rank/Assignment
Officers		
Robert F. SCOTT†	Jun. 6th, 1868 – Mar. *c.* 29th, 1912	Captain, R.N., C.V.O.
Edward R. G. R. EVANS	Oct.28th, 1880 – Aug. 20th, 1957	Lieutenant/ later Commander, R.N.
Victor L. A. CAMPBELL*	Aug. 20th, 1875 – Nov. 19th, 1956	Lieutenant, R.N.
Henry R. BOWERS†	Jul. 29th, 1883 – Mar. *c.* 29th, 1912	Lieutenant, R.I.M.
Lawrence E. G. OATES†	Mar. 17th, 1880 – Mar.17th, 1912	Captain 6th Inniskilling Dragoons
G. Murray LEVICK*	July 3rd, 1876 – May 30th, 1956	Surgeon, R.N.
Edward L. ATKINSON	Nov. 23rd, 1881– Feb. 20th, 1929	Surgeon, R.N.
Scientific Staff		
Edward A. WILSON†	Jul. 23rd, 1872 – Mar. *c.* 29th, 1912	M.A., M.B., Chief –Scientific Staff
George C. SIMPSON	Sep. 2nd, 1878 – Jan. 1st, 1965	D. Sc. Meteorologist
T. Griffith TAYLOR	Dec. 1st, 1880 – Nov. 5th, 1963	B.A., B.Sc., B.E., Geologist
Edward W. NELSON	Jun. 6th, 1883 – Jan. 17th, 1923	Biologist
Frank DEBENHAM	Dec. 26th, 1883 – Nov. 23rd, 1965	B.A., B.Sc., Geologist
Charles S. WRIGHT	Apr. 7th, 1887 – Nov. 1st, 1975	B.A., Physicist
Raymond E. PRIESTLEY*	Jul. 20th, 1886 – Jun. 24th, 1974	Geologist
Herbert G. PONTING	Apr. 13th, 1870 – Feb. 7th, 1935	F.R.G.S., Camera Artist
Cecil H. MEARES	1877–1937	In Charge of Dogs
Bernard C. DAY	Aug. 18th, 1884–1934	Motor Engineer
Apsley CHERRY-GARRARD	Jan. 2nd, 1886 – May 18th, 1959	B.A., Asst. Zoologist
Tryggve GRAN	Jan. 20th, 1888 – Jan. 8th, 1980	Sub-Lieutenant, Norwegian R.N.
Men		
William LASHLY	Dec. 25th, 1867 – Jun. 12th, 1940	Chief Stoker
Walter W. ARCHER	May 25th, 1869 – Jan. 28th, 1944	Chief Steward
Thomas CLISSOLD	Nov. 9th, 1881 – Oct. 20th, 1963	Cook, late R.N.
Edgar EVANS†	Mar. 7th, 1876 – Feb. 17th, 1912	Petty Officer, R.N.
Robert FORDE	Aug. 29th, 1875 – Mar. 13th, 1959	Petty Officer, R.N.

Name	Life-Time	Rank/Assignment
Thomas CREAN	July 20th, 1877 – July 27th, 1938	Petty Officer, R.N.
Thomas S. WILLIAMSON*	Oct. 6th, 1877 – Jan. 20th, 1940	Petty Officer, R.N.
Patrick KEOHANE	Feb. 12th, 1878 – Aug. 30th, 1950	Petty Officer, R.N.
George P. ABBOTT*	Mar. 10th, 1880 – Nov. 22nd, 1923	Petty Officer, R.N.
Frank V. BROWNING	Jun. 27th, 1882 – Mar.14th, 1930	Petty Officer, 2nd Class, R.N.
Harry DICKASON*	Dec. 16th, 1884–1943	Able Seaman, R.N.
Frederick J. HOOPER	Mar. 28th, 1890 – Jun. 20th, 1955	Steward, late R.N.
Anton OMELCHENKO	1883 –1932	Groom
Dmitrii GIREV	Jun. 1st, 1889–1932	Dog Driver

† Perished during the South Pole journey. * Northern Party at Robertson Bay near Cape Adare (–71.283333, 170.233333).

[1] The names and ranks of fellow explorers are taken from Scott, Vol. I, *cf.* p. xix. The dates for their lifetimes are taken from various sources, mainly from John Stewart, *Antarctica: An Encyclopedia,* Second Edition, McFarland & Company, Inc., London, 2011 and Beau Riffenburgh (Ed.), *Encyclopedia of the Antarctic*, Routledge, Oxon, 2007.

In all available historical accounts, the authors make remarks/comments or the tacit assumption that Edward L. Atkinson, who as soon as he returned with the First Return Party (Jan. 26th, 1912), somehow assumed command at Cape Evans. However, if one tries to find a historical foundation for this notion, one is left in vain.

In Tab. 10.4, I collected names and rank/assignment of all personnel (The Shore Party) of the *Terra Nova Expedition*. Three "categories" of personnel are to be distinguished: (1) Officers, (2) Scientists, and (3) Men. The list of officers is presented in order of each person's rank. The list of ranks is rather artificial, since the expedition was Captain Scott's private undertaking, with his unlimited powers of single person command. Thus, Edward R. G. R. Evans' rank in Captain Scott *Terra Nova Expedition* was second in command. In Captain Scott's own words

> Wilson, Evans, and I went to the Cape, which I had now rechristened Cape Evans in honour of our excellent second in command.

However, Lt Evans was second in command due to his nomination directly by Captain Scott. In any case, in the absence of Captain Scott it was Lt Evans who would be in charge.

At the time of Dr Atkinson's return, both Captain Scott and Lt Evans were still continuing their journeys, and it was Dr Simpson who was in charge at Cape Evans by Captain Scott's written orders. The First Return Party did not carry verbal or written instructions from Captain Scott to change the command at Cape Evans. Yet apparently, a change of command supposedly occurred at Cape Evans, since after Dr Atkinson's return command was transferred to him. The change of leadership at Cape Evans is indeed strange. Since Dr Simpson was according to Captain Scott "fully aware" of his "plans and wishes," did he or did he not pass this knowledge on to Dr Atkinson?

This is the second serious instance when at Cape Evans, Captain Scott's explicit and written orders were deliberately changed. The first instance was when Dr Simpson did not properly follow Captain Scott's flawed orders to re-supply One Ton Depôt with the necessary 5 X.S. rations instead of the inadequate 3 X.S. rations. The second instance was that Dr Simpson gave up (transferred, abandoned) his command of Cape Evans *without* being discharged by Captain Scott.

One could speculate that upon his return, Dr Atkinson noticed that Captain Scott's orders were not followed, leading him to assume control in an attempt to follow these orders and deliver at One Ton Depôt the remaining 2 X.S. units and dog food. Thus, out of 9 well-rested explorers (see Tab. 10.2) and some more than well rested sledging dogs, Dr Atkinson would launch a re-supplying party. None of that however happened. 13 men, including the First Return Party, were sitting idle at Cape Evans.

On the day of Dr Atkinson's return, Jan. 26th/28th, 1912, and on his "self-assumption" of the command of Cape Evans, he had a number of options to re-supply One Ton Depôt with 2 X.S. units and dog food:

- send a well-rested Meares with dogs,
- send other men and a dog party,
- send only a man party.

These options were self-evident, and more importantly since Dr Simpson according to Captain Scott's written comment was "fully aware of my plans and wishes," must be "somehow" carried out. But *no one* at Cape Evans was interested in being involved in the action to support Captain Scott and his fellow explorers. What could be more important than following the non-flawed portion of Captain Scott's orders? Without 2 X.S. units delivered at One Ton Depôt, Captain Scott would not have had enough food and fuel for the last leg of the return journey. Was not this alarming?

I picture the following. Right after the arrival of the First Return Party, Dr Atkinson and the party were "debriefed" by fellow explorers at Cape Evans, who were eager to learn about the Captain Scott party. According to Silas, Dr Atkinson's party brought[16]

> with them the news that the other eight men were heading south and going strong. They brought back some mail, as well as plates and films exposed by Scott and Bowers

In addition to the above news and according to the only source, Cherry-Garrard[17]

> Atkinson was in command, and before we left Scott told him to bring the dog-teams out to meet the Polar Party if, as seemed likely, Meares returned home.

and[18]

> Before we left Scott at the top of the Beardmore he gave him orders to take the two dog-teams South in the event of Meares having to return home, as seemed likely.

There are a few important issues with the above instructions apparently given to Dr Atkinson by Captain Scott.

The first issue is that only Cherry-Garrard made such a statement. These instructions are not confirmed by Captain Scott or by Dr Atkinson himself. I would be incorrect by not adding that Dr Atkinson indirectly confirmed the notion of the Captain Scott instructions cited above by writing "entirely from his [Cherry-Garrard's] diaries and from the official diary kept by him that these records are compiled."[19]

The second issue is Cherry-Garrard's comment attributed to Captain Scott that it was likely that Meares would return home. It was not certain that Meares would return home in October 1911 when Captain Scott in his written *Instructions for Commanding Officer "Terra Nova"* observed that "Meares may possibly return; it depends on letters from home."

The third issue is quite pragmatic: why did Captain Scott order Dr Atkinson, in particular, to "bring the dog-teams out to meet the Polar Party"? It is a very strange request. As much as one can criticize Captain Scott on many subjects, one can observe his insight and indeed careful logistic planning of the journey. To ensure proper organization, Captain Scott issued written orders to Dr Simpson and Meares. He also sent a written note to Dr Simpson with the Day and Hooper Party to ensure proper actions being executed at Cape Evans.

At the time of departure of the First Return Party, Captain Scott apparently was in good spirits and still hoping to reach the Pole before Captain Amundsen. Actually, it appears that the order given to Dr Atkinson by Captain Scott as described by Cherry-Garrard is a *post factum* invention, or Captain Scott lost his mind at the top of the Beardmore and could not recall his previous orders and wishes. However, I am certain that on Dec. 22nd, 1911, Captain Scott was in possession of all his mental powers, and he could not make such an error by asking Dr Atkinson "to bring the dog-teams out to meet the Polar Party". The reason for this deduction lies in the numbers.

The actual sledged distance from Hut Point to the Upper Glacier Depôt from where the First Return Party was returning is about 462.5 miles. It would mean, according to Captain Scott's plan (10.1 miles/day), that the party would need 46 days to return to Hut Point. It would mean also that Captain Scott could estimate (calculate) that the First Return Party could return on Feb. 6th, 1912. In reality, the party was sledging faster than Captain Scott assumed. However, this is a *post factum* observation. Captain Scott did not have it at his disposal and could only reason within his original sledging plan.

Thus on Dec. 22nd, 1911, when the First Return Party sledged home, Captain Scott's understanding of actions undertaken by Dr Simpson at Cape Evans was simple and as described in his orders to Meares and Dr Simpson. After all, there was a good reason that Captain Scott issued written orders in October 1911. Therefore, Captain Scott expected that on Feb. 6th, 1912, the date of the First Return Party's arrival at Hut Point, the ordered action "about the first week of February I should like you to start your third journey to the South" would take place. In Captain Scott's scenario, Dr Atkinson was to shake hands with Meares/Dmitrii at Hut Point or Corner Camp and wish them a safe journey.

Cherry-Garrard's whole counterfactual description is based on his *post factum* knowledge that Meares returned home on the *Terra Nova*, which departed from Cape Evans on Mar. 4th, 1912. However, at the time of actual events, no such knowledge was available[20] and Captain Scott's original orders and estimations were pending execution

> Assuming that the ship will have to leave the Sound soon after the middle of March, it looks at present as though you [Meares] should aim at meeting the returning party about March 1 in Latitude 82° or 82°30′. If you are then in a position to advance a few short marches or "mark time" for five or six days affecting your object.

On Mar. 1st, the Captain Scott party reached 81°35′S (–81.58333) and 82°30′S (–82.50) on Feb. 23rd.

The following is a theoretical estimation of position according to Captain Scott's 144-days plan. If one was to meet the Captain Scott party on March 1st and catch the *Terra Nova* "in the middle of March (say the 15th), the whole party had to sledge back at 20 miles/day. That was the assumption given by Captain Scott in his orders to Meares. The experienced Meares and Dmitrii certainly could achieve this velocity. The reader may recall that Cherry-Garrard and Dmitrii dog-sledged back to Hut Point with a velocity 19.7 miles/day. The reader may also recall Lt Bowers' expectation that Meares and Dmitrii would achieve 30 miles per day during their return from the Beardmore.

I think that under favorable weather conditions, it was certainly possible for a team consisting of only Meares and Dmitrii (two sledges and two dog teams) to sledge in the Russian custom back to Hut Point in two weeks' time after meeting the Captain Scott party. However, after meeting Captain Scott, I think it was simply impossible to achieve the expected velocity if they were assisting the Captain Scott party's return. This would require increasing the weight of each sledge by 2 men weights. Thus, the weight carried by each dog team would be 3 men weight, which is 3×150 [℔ ≈ 68 kg] = 450 ℔. By adding to it the weight of the explorers gear, one without going into more detailed calculations can see that the dogs would effectively not handle these weights.

However, if the Russian custom could not be used because Captain Scott was not willing to accept it, one can see that as in the case of simultaneous pony, dog, and human sledging, the velocity is limited by its slowest element. Therefore, one more time Captain Scott was falling into this multi-velocity trap. This time, the slowest element was a man and his sledging velocity. Therefore, one could not rationally expect that Meares and Dmitrii would significantly increase the return time of the Captain Scott party.

Thus Cherry-Garrard's comments[21]

> I hope I have made clear that the primary object of this journey with the dog-teams was to hurry Scott and his companions home so that they might be in time to catch the ship if possible.

and[22]

> In the event of Scott deciding to return home the dog-teams might make the difference between catching or missing the ship.

are entirely uneducated.

Meares and Dmitrii, upon their arrival and meeting the Captain Scott party, would make a difference at least on four accounts:

- sociological by increasing morale,
- assisting in dragging Captain Scott's party sledge,

- occasional Russian custom uses of dog sledges,
- or just rushing Captain Scott's press release to be taken by the *Terra Nova*.

On Mar. 10th, 1912, Captain Scott made his famous comment[23]

> The dogs which would have been our salvation have evidently failed.* Meares had a bad trip home I suppose. It's a miserable jumble.

This particular comment is unusual. Since, in his own orders, Captain Scott ordered Meares to meet his party about "March 1 at latitude 82° or 82°30′" why is he commenting on Meares' failure only on Mar. 10th? The second concern is less unequivocal. This concern is: why does Captain Scott make reference only to Meares and the dogs, and *does not* make reference to Atkinson? Thinking in terms of logic, one would formulate a grammatical conjunction "Atkinson with dogs, or Meares with dogs".

The asterisk (*) in the above Captain Scott line was originally added by Leonard Huxley, who with the help of Cherry-Garrard, as we know from previous chapters, edited Captain Scott's journals. It is worth reciting here a part of Huxley's comments to which the asterisk is referring[24]

> For the last six days the dogs had been waiting at One Ton Camp under Cherry-Garrard and Demetri [Dmitrii]. The supporting party had come out as arranged [*sic*] on the chance of hurrying the Pole travellers back over the last stages of their journey in time to catch [*sic*] the ship. Scott had dated his probable return to Hut Point anywhere between mid- March and early April. Calculating from the speed of the other return parties, Dr Atkinson looked for him to reach One Ton Camp between March 3 and 10.

We already know how to read counterfactuals. Huxley is just about correct that it was arranged that the party would be dispatched from Hut Point to meet the returning Captain Scott. Actually, he presents one of the regrettable techniques of responding to someone's question. If one asks the question: Why the dog party was not dispatched from Hut Point? Huxley has already answered that there was no order given to Meares or Dr Atkinson.

But not only that, at first glance Huxley also manipulated the date (Mar. 3rd and 10th) to justify and excuse Dr Atkinson and Cherry-Garrard from One Ton Depôt in an alleged rescue/support mission.

The actual sledged distance between the South Pole and One Ton Depôt is 631 miles. In order to calculate a possible day of return to One Ton Depôt, one could use the average velocity of the returning parties which is about 13.2 miles/day, as taken from Fig. 2.3, and the velocity assumed in Captain Scott's 144-days sledging journey, 10.1 miles/day. These velocities give an educated guess of possible return dates of between Mar. 6th and 21st, which *differ* from Huxley's time frame of Mar. 3rd and 10th, which is the exact same period at which Cherry-Garrard leisurely camped at One Ton Depôt in 1912. This is the fingerprint not of Huxley, but of Cherry-Garrard. One should also observe that the first possible return date, Mar. 6th, is a rather optimistic estimation, as Captain Scott's party was sledging about a month longer than the returning parties, which could affect overall velocity. Finally, it is reasonable to allow some extra delay due to blizzards.

Having at his disposal the professional dog sledge drivers Meares and Dmitrii, Captain Scott supposedly selected Dr Atkinson. Assuming that it was indeed the case, one immediately comes across a number of questions. According to Dr Atkinson, he was asked[25]

> to proceed as far south as possible, taking into consideration the times of return of the various parties, and in order to hasten the return of the final party.

It is worth reading Dr Atkinson's above account again to understand its self-contradictory meaning. Dr Atkinson was supposed to consider multiple issues before proceeding as far south as possible.

The first issue was to consult with Dr Simpson about his previous actions. We know nothing about possible consultations, as well as whether Dr Simpson debriefed the Dr Atkinson party upon their return. The meeting of both Dr Simpson and Dr Atkinson was the most crucial moment in the following events. However, literally nothing is written about the encounter and the possible transfer of duties from Dr Simpson to Dr Atkinson. But not only that. An even more perplexing question arises: why, and on what basis, did Dr Atkinson assume command of Cape Evans? Or why, and on what basis, did Dr Simpson acquit himself from Captain Scott's written nomination to command Cape Evans?

⋮

Before proceeding further, let me pause here and try and account for Dr Simpson's relinquishing command of Cape Evans. It has been suggested that upon the *Terra Nova's* arrival and due to letters received by Dr Simpson, he

> was recalled to [his] work in India[26]

> [was] recalled by the Indian Government[27]

> had to return to his work in India[28]

> [his] absence from the Indian Meteorological Office at Simla would have expired[29]

> recived news of illness and staff shortage in his Simla office when the *Terra Nova* returned bringing mail at the begining of February and he decided he must return with the ship.[30]

The above expoundings – given by Dr Simpson himself, Lt Evans, Cherry-Garrard, Ponting, and the editors of Wright's diaries respectively – to justify Dr Simpson relinquishing his duties with the expedition, diffused in various mutated forms into modern historical accounts. What is indeed striking in these modern accounts is that the authors entirely dismiss the elementary fact that according to Captain Scott's direct nomination, Dr Simpson was in charge of Cape Evans' affairs. However, according to some authors, the return of Dr Atkinson meant automatic discharge of Dr Simpson, and his assistant Charles Wright commented[31]

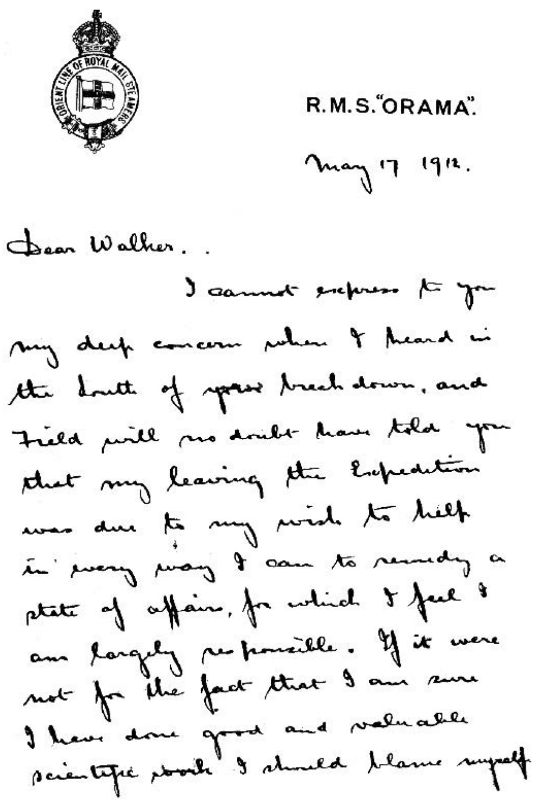
> Atkinson felt he must stay with Evans and sent Demetri [Dmitrii] and Crean and a dog team back to Cape Evans on February 23 with the news of Evans'

> state of health and a request to Simpson – who was in charge there – that either Wright or Cherry-Garrard take Atkinson's place with the dog teams, and go south to One Ton Depot with Demetri [Dmitrii].

The reason of being recalled by the government sounds like a very convincing argument to escape from Antarctica, to desert Captain Scott and ignore his written orders. However, was Dr Simpson really recalled from Antarctica? The answer to this question can be found in one of his letters to Dr Gilbert T. Walker, of which a copy is presented in Fig. 10.2 and transcribed below[32]

> R.M.S. „Orama".
> May 17, 1912
> Dear Walker.
> I cannot express to you my dear concern when I heard in the South of your breakdown, and [John] Field will no doubt have told you that my leaving the Expedition was due to my wish [*sic*] to help in every way I can to remedy a state of affairs, for which I feel I am largely responsible.

Dr Simpson's above account is self-explanatory. Dr Simpson's premature departure from Cape Evans was voluntary and he states his wish to help with work at the



R.M.S. "ORAMA".

May 17 1912.

Dear Walker..

I cannot express to you my deep concern when I heard in the South of your break down, and Field will no doubt have told you that my leaving the Expedition was due to my wish to help in every way I can to remedy a state of affairs, for which I feel I am largely responsible. If it were not for the fact that I am sure I have done good and valuable scientific work I should blame myself

Figure 10.2. A copy of Dr Simpson's May 17th, 1912 letter to Dr Walker.

Indian Meteorological Department in Simla. Yet it also makes no sense. Dr Simpson is flat out implying that his absence directly caused Dr Walker's health issue. This is nonsensical, and could only have been an excuse for pulling the ejection handle and ejecting from Antarctica. In fact, Dr Simpson later on in the letter confesses that there was no critical shortage of staff at Simla: "I am writing to Field to say that I shall return to India a week before he leaves so that I shall be able to pick up the threads of the work, before I officially return to duty."

Indeed, Dr Simpson faced a tough choice between continuing meteorological work in Antarctica or returning to Simla and helping there. Since all departments of meteorological scientific research in Antarctica were apparently running according to research standards and under the expert eye of Charles Wright, one could understand Dr Simpson's wish to return to carry out equivalent meteorological research at Simla.

However, in this case, the lives of his fellow explorers – Captain Scott, Dr Wilson, Captain Oates, Lt Bowers and Petty Officer Evans – were at stake. It is indeed incomprehensible why Dr Simpson, during the most important time of the expedition, was sitting idle at Cape Evans and then decided to sail away on the *Terra Nova* under a false pretence.

Following the alleged urgency of helping in Simla, one would rightly assume that Dr Simpson sailed to India and then went up to Simla. However, this did not happen despite its relative ease.[33] First, Dr Simpson declared

> For your sake I am sorry Govt. did not ask me to return immediately

Then, in contradiction to his above wish, he declared that he would go to England

> to see my people and to talk over with Dines[34], Shaw[35] and Chree[36] of my work in the South.

The investigative reader may recall that Drs Dines, Shaw, and Chree were directly involved in setting up a groundless attack on Captain Scott over the issue of Lt Royds' wind data (see section 1.5). In section 1.5, using modern wind data, I explained why their accusation was wrong and was invented to sabotage Captain Scott's reputation. However, one could also, using wind data measured during the *Terra Nova Expedition*, easily discover that changes in wind direction stated by Drs Curtis and Dines over the Barrier were simply incorrect. I wonder if Dr Simpson in 1912 discussed with Drs Dines, Shaw, and Chree, otherwise distinguished scholars, the issue of the Royds wind data from the *Discovery Expedition*.

One could weakly try to claim that Dr Simpson was recalled by citing this from near the end of this letter

> I have received the cable giving the date of my return for August 23rd. As that is the date of Field's leaving I shall be out, as I said above, a week earlier.

The excuse is ambiguous and does not bear examination, as one quickly sees further back in the letter

> When I got Field's cable saying you were returning to India I felt hugely delighted. I hope you are now in perfect health again.

If Dr Walker was in the process of returning to India, why would Dr Simpson continue his ejection in April 1912, which is when he would have received this cable?

Why would he not wait in New Zealand or Australia for the *Terra Nova* to return to pick him up for the return journey to Antarctica?

A year later, Dr Simpson felt obliged to compose another next letter to Dr Walker, and made another disturbing statement[37]

> 20 Feb 1913
> Dear Walker,
> The awful news about Captain Scott has come as a great blow & shock to me, and I have just passed a wretched week. The way the news has drilled to India has made it doubly painful. I can now form some idea of what happened to Scott's party, but there has not been a word as to what was done to succour [*sic*] him, except some wild words questioning whether all possible had been done. I know nothing more was possible [*sic*], but I am very impatient for fuller news which cannot, however, arrive before 1 March.

Dr Simpson, a fellow explorer who practically fled from Cape Evans, a man who disregarded Captain Scott's orders, hypocritically wonders about what have been "done to succour" Captain Scott. We know – and this is *not post factum* knowledge – what should have been done back in early 1912. Dr Simpson and others should have followed Captain Scott's written orders given to him in October 1911. If for one reason or another it was difficult to follow these orders, then Dr Simpson and others should have reorganized their actions to ensure the safety of the Captain Scott party.

Dr Simpson's self-justification or chilling certainty in the letter to Dr Walker "I know nothing more was possible" is either of unparalleled ignorance and humiliating in its nature, or an implicit confession that he gave orders to prevent Cherry-Garrard and Dmitrii Girev from ever rendezvousing with Captain Scott. The letter is dated Feb. 20th, 1913, that is 10 days after Feb. 10th, 1913, when Dr Edward Atkinson and Lt Harry Pennell touched land in the New Zealand port of Oamaru.

However, if Dr Simpson did not know what more was possible, let me point out a short list of what should have been done back in 1912 when he was in charge of Cape Evans and indeed in charge of the Captain Scott party's lives:

- Dr Simpson should have stayed to the end at Cape Evans,
- Wright and Dmitrii should have gone as First Relief Party if Meares had to leave,
- All the available men, including the *Terra Nova*'s crew if necessary, should have been launched from late December 1911 to implement the order of re-supplying the depôts and sending dogs to meet the Captain Scott party.

Roughly one year later, Dr Simpson wrote to Dr Walker yet again and felt obliged to make yet another disturbing statement[38]

> Simla
> Feb 23, 1914
> My dear Walker,
> Very many thanks for your kind letter of congratulations. I came back from the Antarctic because there was no other course open to me [*sic*], but it is good to know that you appreciate my action.

About ten years later, in response to the *Nature* review[39] of his first volume on Antarctic meteorology, Dr Simpson felt obliged to declare that his original statement

> I was recalled to my work in India when the Terra Nova returned to the Antarctic in January, 1912.

was wrongly interpreted to mean that he was recalled from Antarctica "officially by the Government of India". His obligation was natural: the reviewer unwittingly publicizing Dr Simpson's deception in a public forum would increase the risk of the Indian government discovering his lie of being recalled. Dr Simpson then explained that he had been ready to ask the Indian government to prolong his stay in Antarctica[40]

> When the Terra Nova arrived in January, 1912, she brought me a letter from Mr. Field telling me that Dr. Walker had gone to England seriously ill, and that he himself was so unwell that he did not see how he could carry on. In these circumstances I felt it was my duty to my colleagues in India to return at once.

Thus, finally, we know directly from Dr Simpson that he discharged himself from Captain Scott's written nomination to command at Cape Evans because he felt it was his duty to his "colleagues in India to return at once". One more time, Dr Simpson is telling us that his colleagues in India were more important than Captain Scott's orders. Strangely, Dr Simpson never mentioned Field being ill in his 1912 letter to Walker.

The investigative reader is also bothered by Dr Simpson's superficial account that

> It is, therefore, only fair that I should state the facts. I was granted three years' leave by the Government of India, which would have been sufficient if Capt. Scott's original plan of staying only one year in the Antarctic had been carried out. When, however, it was clear that the expedition would remain two years, I told Capt. Scott that I would stay the second year and write to India asking for my leave to be prolonged.

Dr Simpson was granted three years' "leave without pay" by the Indian government in November 1909.[41] It meant that he should be back in Simla in November 1912. How was Dr Simpson planning to return in November 1912, since the *Terra Nova* was expected to return to Cape Evans in January and sail away in March 1912? Thus taking into account dates and sailing times, he possibly could return to Simla in 1913, about 6 months overdue his agreed return.

Of course, that is not quite what happened. Dr Simpson was not recalled, but mutinied and decided to pay a visit to England. I was unable to track down Dr Simpson in the UK incoming passenger lists, but I did catch him on one of the UK outbound passenger lists, departing London for Bombay on July 26th, 1912 aboard the P&O liner RMS Mooltan.[42] The investigative reader will also notice that Dr Simpson's claim of being granted three years' leave – and thus having a return date fixed in advance – is directly contradicted by his 1912 letter to Walker, where he states that the date of his return had recently been set as Aug. 23rd by a telegraph message.

Either way one thinks about Dr Simpson's explanation, he/she runs into a *cul de sac*. A guilty person never behaves naturally.

Fifty-one years later, E. Gold, who was writing Dr Simpson's obituary for the Royal Society [*sic*], certainly didn't know about Dr Simpson's mutiny and lie about being recalled to India when he wrote[43]

> During the fourteen months before his *unexpected return* [emphasis mine] in the *Terra Nova* in March 1912 Simpson was fully occupied …

In 1789, Quartermaster's Mate George Simpson remained loyal to Captain Bligh in the mutiny on the Bounty.[44] 123 years later, his namesake turned Fletcher Christian and committed mutiny.

⋮

After a little detour of the actual events at Cape Evans, let us look at Dr Atkinson's actions. Before that, let me one more time discuss some additional aspects of the orders given to Meares by Captain Scott. Obviously, these orders were given to Meares but then subsequently to Dr Simpson since he was in charge, and was also obliged to make sure that these orders were implemented.

These orders would have to begin execution on Jan. 4th, 1912, when Meares and Dmitrii returned and Dr Simpson was in charge of Cape Evans and Hut Point. Both of them immediately chose to ignore Captain Scott's orders, and both of them chose no action. Was there a special reason why Dr Simpson did not order Meares to resupply One Ton Depôt with additional food rations and food for the dogs?

Indeed, Captain Scott asked Meares to sledge within his contingency plans described in the orders written in October 1911. Meares did not return to Hut Point by Dec. 19th, 1911, and thus the alternative in Captain Scott's orders was carried out by Day's Depôt Party. Meares did not return to Hut Point by Jan. 13th, 1912, to do nothing "on the Southern road". Meares and Dmitrii returned on Jan 4th. Was it still feasible that they could go on the Southern road to deliver dog food and 2 X.S. rations? The answer is: yes it was feasible. The plan could be like the following.

After returning, Meares, Dmitrii, and the dogs would take a one week rest. During this time, the dogs would be allowed to consume as much as they liked. After the rest, the party would sledge and re-supply One Ton Depôt. One would assume the lower bound of their average velocity to be about 14.5 miles/day, which is the same as on the return trip from the Barrier (see Fig. 10.1). The average velocity 14.5 miles/day is indeed a slow one, as Cherry-Garrard was capable of dog sledging at 16.9 miles/day.

Since One Ton Depôt is about 118 miles from Hut Point *via* Corner Camp, it would take 2×118 [miles]/14.5 [miles/day] ≈ 16 days and the party would return on about Jan. 27th. This is *precisely* as Captain Scott calculated, and why he formulated his order that the "depot should be laid not later than January 19".

Having done so, one more time Meares, Dmitrii, and the dogs could rest at Hut Point for one week enjoying an unlimited food supply. Then, as Captain Scott expected and described in his orders, the party of Meares and Dmitrii could depart on Feb. 3rd in an attempt to meet the main Southern Party at about 82° to 82°30′S.

The above analysis shows that Captain Scott's orders could have been readily implemented by Meares, Dmitrii and Dr Simpson. None of that happened!

Before returning to Dr Atkinson's actions, let me show that in estimating and requesting to be met by Meares and Dmitrii, Captain Scott indeed created a contin-

gency plan. Let me recall a similar contingency plan developed by Captain Scott in the way how the depôts were stocked with food and fuel. I discussed this contingency issue in Chapter 9, and in here I just want to mention that by increasing or decreasing sledging velocity, Captain Scott could in the desired way change the amount of food to be carried.

In Tab. 10.5, I presented theoretical dog sledging velocities to be achieved by the Meares and Dmitrii party to reach the Captain Scott party at the two locations given in his orders to Meares as a range. One can see that in order to reach the destinations, Captain Scott assumed *very low* dog sledging velocities. That was Captain Scott's contingency plan calculated for Meares' dog party. If either party, Meares' or Captain Scott's, was sledging at higher velocities, they would meet at a different location ahead of the scheduled time of Mar. 1st, 1912.

Table 10.5. Theoretical dog sledging velocities calculated for different departure dates from Hut Point, and locations to be reached by Meares and Dmitrii party in 1912.

Departure until Arrival Dates	Location 82°S (263 miles)	Location 82°30′S (302 miles)
Feb. 1st until Mar. 1st (29 days)	9.1 miles/day	10.4 miles/day
Feb. 7th until Mar. 1st (22 days)	12.0 miles/day	13.7 miles/day

Unfortunately for Captain Scott, his comrades and fellow explorers who reached the South Pole, and for the *Terra Nova Expedition*, no action was taken by Meares and Dr Simpson. Despite clear and written orders from Captain Scott, both Cecil Meares and Dr Simpson practically abandoned the expedition while staying at Cape Evans. Their passive resistance to Captain Scott‘s orders and unexplainable false reasoning in order to leave Antarctica can only be construed as mutiny.

Before I arrived at this conclusion, it had already been suggested that Meares was involved in mutiny[45]

> I am afraid [observed Cherry-Garrard] it is becoming clear that the not laying of this depot by Meares was more or less deliberate. I have always had a feeling that Meares let the whole show down in some rather indefinite way: I have also had the feeling that he got off very lightly …

We now see from the above analysis see that it was not Meares alone. Somehow, and for no clear reason, he was joined by Dr Simpson.

⋮

It appears that since the dispatch of Day's Party on Dec. 26th, 1911 until the middle of February, no actual or speculative action was undertaken by home base personnel. From Table 10.2, we see that the number of fellow explorers present at Cape Evans/Hut Point was continually increasing up to an eventual 13 personnel + the entire *Terra Nova* crew under the command of Lt Harry Pennell, RN on Feb. 5th, 1912.

From the above point of view, one immediately wonders why Captain Scott's orders were not implemented. To employ a weak explanation, one could say that everyone was busy with unloading the *Terra Nova*. However, according to Cherry-Garrard[46]

> We started unloading on February 9, and this work was continued until February 14: there was about three miles of ice between the ship and the shore and we were doing more than twenty miles a day.

Cherry-Garrard's above account was also recorded by Dr Atkinson, who confirmed that "all hands were employed".[47] It appears that unloading the *Terra Nova* served as an excuse for not following Captain Scott's orders.

Unloading supplies delivered by the *Terra Nova* was indeed important; however, was it more important than re-supplying One Ton Depôt, even if the first week of February window was missed? Alternatively, both unloading and re-supplying could be undertaken simultaneously. Would it make a difference in the unloading of *Terra Nova* if two fellow explorers went south as Captain Scott ordered? Was nobody there to replace Meares? By looking at Tab. 10.2, which lists the names of the explorers present at Cape Evans/Hut Point, one could propose a number of name pairs of fellow explorers who could follow Captain Scott's orders.

Still nothing happened. But then Dr Atkinson, without an apparent pre-calculated argument and justification, observed that[48]

> On February 13, the sea ice having started to break up in the south bay, I judged it advisable to make a start with the two dog teams for Hut Point, 15 miles to the south of Cape Evans, a journey across sea ice.

Thus, Dr Atkinson and Dmitrii departed from Cape Evans on Feb. 13th, 1912 in an attempt to meet the Captain Scott party. However, their departure resulted rather from the fact that "the sea ice started to break" than from the previously issued orders from Captain Scott. This is by itself surprising.

Indeed, no one at Cape Evans, including Dr Simpson, was even making contingency preparations for possibly sledging south to meet the Captain Scott party. The starting point was Hut Point, which had direct access to the Barrier. Since the easiest route from Cape Evans to Hut Point is across the McMurdo Sound, during the summer months the Barrier was not easily reachable from Cape Evans, and when the sea ice is broken the route is closed. The sea ice breaking time is a complex phenomenon dependent on many unpredictable phenomena. Therefore, to ensure access to the Barrier all people, dogs, and food for both of them and for the depôts should be stored at Hut Point. Evidently, in February 1912 this precaution and contingency plan was not implemented by Dr Simpson and Dr Atkinson. Although Captain Scott was not ordering a specific transfer of men and animals, he was very aware of the potential dangers, and in orders given to Dr Simpson he commented[49]

> You will remember that as the summer advances certain places in the solid floe become dangerously weak. It should be well to keep watch on such places, especially should they occur on the road to Hut Point, over which parties may be travelling at any time. It is probable there will be a rearrangement of the currents in the region of Tent Island since the breaking of the Glacier Tongue.

After arriving at Hut Point on Feb. 13th, Dr Atkinson writes in his account of events[50]

> The two dog teams, Demetri [Dmitrii] the Russian boy, and myself were kept at Hut Point by bad weather until February 19.

Even without a quantitative analysis, one wonders if is it possible that Dr Atkinson and Meares were "kept at Hut Point by bad weather" for 5 consecutive days. The investigative reader may recall that Captain Scott was stopped in December 1911 by 4 consecutive days of bad weather. Did Dr Atkinson experience even a bigger period of weather disturbance – another black swan weather event – prohibiting his sledging south? What does Dr Atkinson mean by saying "bad weather"?

Let me look more closely at the question of weather during this time. On Fig. 10.3, I depicted wind velocity measured at Cape Evans during Dr Atkinson's "Attempt To Meet The Polar Party," as he called it. It is indeed an intriguing title. Finally, someone is at least attempting to follow Captain Scott's orders/instructions, with a lag in the range of one to two weeks later than originally ordered. Recalling that the dog food was not transported to One Ton Depôt, one could ask the question: did one/two week's departure delay make such a difference? Or was it necessary to deposit dog food at One Ton Depôt to dog-sledge to meet the Captain Scott party, as ordered

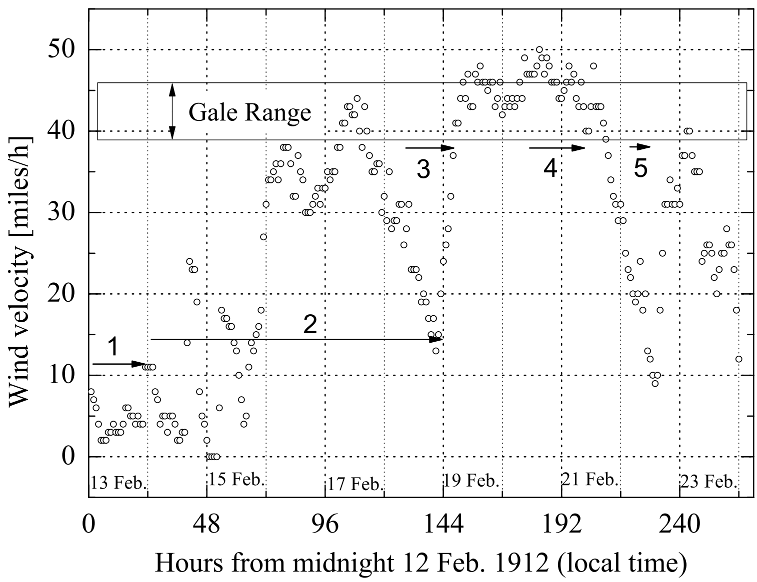


Figure 10.3. Wind velocity in miles/hour recorded at Cape Evans from midnight of Feb. 12th, 1912.[1] The following abbreviations have been used. 1 – Dr Atkinson with Dmitrii sledges from Cape Evans to Hut Point. 2 – Dr Atkinson and Dmitrii stay at Hut Point. 3 – Tom Crean goes on alone to fetch help and arrives at Hut Point. 4 – Dr Atkinson and Dmitrii dog-sledge toward Corner Camp. 5 – The party of Teddy Evans, Lashly, Dr Atkinson, and Dmitrii sledging back to Hut Point. The length of black line with an arrow represents the approximate time of a given party action.

[1] George C. Simpson, *Meteorology*, Vol. III, *Tables*, Harrison and Sons, Ltd., London, 1923, *cf.* Table 13.

in his instructions? Recalling that Captain Scott ordered Meares to start his journey "about the first week of February," Dr Atkinson's departure on Feb. 13th was not a significant delay.

To give an answer to the above questions, let us look at what one may call the *self-sustained* sledging range of the dog party. Once again, I have to stress that the logistical analysis of Captain Scott's *Terra Nova Expedition* is extremely difficult, due to the lack of basic data in expedition documents and accounts. The aforementioned task can be also stipulated as a question of, how far (in a period of time) could Dr Atkinson dog sledge in a self-sustained manner?

In practical terms, the load of say Dr Atkinson's party can be divided into (i) non-consumable items and (ii) consumable items. Non-consumable things include all party gear, and consumable things include food and fuel. The initial load of the party is diminishing every sledging day, as consumable items like food and fuel are systematically used. The weight of non-consumable items, at least theoretically, should remain constant during the sledging period, however, the weight of sleeping bags and tent was increasing a little due to the freezing of accumulated moisture.

One of the finest *self-sustained* sledging journeys was made by Captain Scott and his comrades, who man-hauled from the foot of Beardmore Glacier to the South Pole and back. Altogether, from latitude –83.3333 on Dec. 8th, 1911 until Feb. 19th, 1912, they crossed in self-sustained conditions about $2 \times 400 = 800$ miles. Since Captain Scott's party was supported by the First and Second Return Parties, one could object to its true self-sustainability. However, as I will show in a moment, this factor is indeed negligible for my purposes.

Without difficulty, one arrives at asking the question about the pulling power of humans and dogs. It is not a trivial question, and it was for a long time the central issue of Polar exploration.

I already mentioned in this book about the negative role of Admiral Sir Francis Leopold McClintock and his bad advice to Captain Scott on sledging dog food rations during the *Discovery Expedition*. His advice was to take half the of weight food that was actually needed by the dogs. This was a nearly fatal error for Captain Scott's party during the *Southern Journey*. This dog feeding error was corrected during the *Terra Nova Expedition* and the dogs were given 1½ ℔ (0.67 kg).

However, here I am not concerned with food intake, but the maximum self-sustained sledging distance. Provided as shown in Table 10.6 that the dogs and humans are well fed and that they must drag a sledge with 1 load, it is shown that if 1 man will drag that load for 1 distance then 2 dogs will drag the same load for 1¼ of that distance.[51] Thus, the efficiency of dog sledging is 1¼ of man-sledging efficiency, which is assumed to be 1.

In reality, these numbers are just a fair approximation, and one should not expect them to be precisely followed or executed. However, right here it is not necessary to find the precise numbers related to the Captain Scott expedition. It is for my purpose satisfactory to know that the self-sustained sledging distance of dog-hauling is the same, or 25% (1¼) more than, self-sustained man-hauling.

This is an important conclusion in relation to the above analyses of Captain Scott's orders and their implementation by Dr Atkinson. Since Captain Scott was capable of self-sustained man-hauling for a distance of about 800 miles, one would readily observe that a similar distance should be achieved by the dog team.

Table 10.6. Estimated pulling power and distance of man and dog.[1]

1. McClintock (1869) data for pulling power and distance. The relationship between ration weight for man and dog is unclear.		
1 man	1 load	1 distance* /day
1 dog	½ load	~2 distance/day
2. McClintock (1875 & 1901) data for pulling power and distance. ***Ration weight for 2 dogs = 1 man food.***		
1 man	1 load	1 distance/day
2 dogs	1 load	1¼ distance/day
2 dogs	1 light load	2 distance/day

[1] Krzysztof Sienicki, *The Never Ending Gale: its Role in Captain Robert F. Scott and his Companions' Deaths*, available at http://arxiv.org/abs/1109.5355

Comparing the above with Captain Scott's orders to Meares saying that he should dog-sledge to locations 82°S (263 miles) or 82°30′S (302 miles), one obviously concludes that Meares and Dmitrii were easily capable of self-sustaining sledging both ways, which would amount to about 600 miles.

This conclusion leads to the next question. Why did Captain Scott order Meares to transport to One Ton Depôt "as much dog food as you can conveniently carry [*sic*] (for a third journey)"? Without a clear answer, one could speculate that since Meares upon his planned early return was not occupied, Captain Scott within his contingency plans ordered him to bring additional dog food for 1911/1912, or for the next year. If Captain Scott was planning the next season's work, he might be preparing provisions at One Ton Depôt as a base for westward sledging across the Barrier to find its nature, but also wind directions to confirm the accuracy of Lt Royds' measurements. It is also possible that Captain Scott was planning a second attempt to reach the Pole if the first failed.

We know that Meares and Dr Simpson did not follow Captain Scott's orders to transport additional dog food to One Ton Depôt, or somewhere between it and Hut Point.

Now it is about time to return to Dr Atkinson and his *Attempt to Meet the Polar Party*. From the above discussion, it is certain that if he was attempting to meet Captain Scott on the Barrier, the meeting place was expected to take place between 81°S and 82°S. That meant also that he was fully loaded and carrying food/fuel for about 6 to 8 weeks. However, his and Dmitrii's journey was short lived. Apparently, on arriving at Hut Point on Feb. 13th he was stuck there until Feb. 19th due to "bad weather".

To look more carefully into this issue, let us return to Fig. 10.3, on which I depicted the change of wind velocity at Cape Evans from Feb. 13th through 23rd. The depicted data was not recorded at Dr Atkinson's location, but about 10.7 miles south from Hut Point at Cape Evans. Is the location difference significant enough that one could observe significantly different near-surface wind velocities? A similar question was addressed in subsection 7.4.3 in relation to daily minimum temperatures. There, the conclusion was reached that a significant (important for analysis and conclusions) difference between minimum temperatures does not exist between the locations of

McMurdo, Cape Evans, and Hut Point. In the case of wind velocities, we have no simultaneous data recorded at Cape Evans and Hut Point.

Fig. 10.4 depicts computer simulations of the airflow in the Ross Island region during wind events. The authors of this research, in order to summarize their findings in an illustrative way, produced a pictorial representation of the results. It is self-evident from this figure, without specifying numerical relationships, that the air flow between Hut Point and Cape Evans is directly related, and one should not expect particular differences in wind velocities especially during the high-velocity wind events.

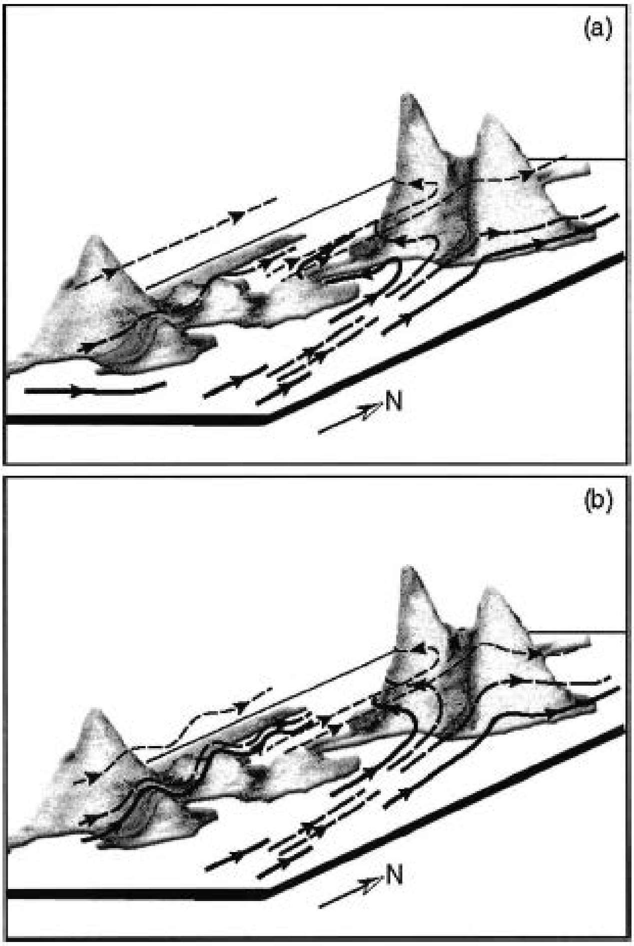


Figure 10.4.[1] Conceptual representation of the wind currents in the Ross Island milieu. Two humps in the far right represent Mount Erebus and Mount Terror, respectively. To the left, the first small bump represents the Minna Bluff. The solid thick lines indicate the air flow near the surface, and the short dashed lines represent upper-level air flow. The intermediate between upper and near surface air flow is illustrated by long dashed lines. Figures (a) and (b) depict light and strong wind events, respectively. © Copyright 2003 American Meteorological Society.

[1] Mark W. Seefeldt, Gregory J. Tripoli and Charles R. Stearns, *A High-Resolution Numerical Simulation of the Wind Flow in the Ross Island Region, Antarctica*, Monthly Weather Review **131**(2003)435–458.

The high-velocity wind event between Feb. 16th and 23rd, 1912 was blowing predominantly from ESE and occasionally from SE and E.[52] That additionally confirms that the high-velocity wind event recorded at Cape Evans must be simultaneously recorded at Hut Point.

Based on the above analysis, and on examination of Fig. 10.4, Dr Atkinson's account that his party was held at Hut Point by bad weather until Feb. 19th is simply not true. Indeed, we do not have a definition of the meaning of bad weather severe enough to stop sledging. However, we know that Dr Atkinson and Dmitrii were not doing leisure dog sledging, but were on a tough assignment to sledge across the Barrier to meet the Captain Scott party. Here, I assume that Dr Atkinson was capable of using a compass to direct the dogs.

Firstly, from Fig. 10.3, one can see that after reaching Hut Point Dr Atkinson could continue sledging at least for the next two days (Feb. 14th and 15th). However, he chose without apparent reason to not continue. After these dates, the wind velocity increased to gale force, and indeed it might have been impossible to dog-sledge. I did say that it might be impossible, since even at about gale force the wind velocity fluctuates and windows for sledging may be available. This possibility is strongly supported by the 18-hour walk undertaken by Tom Crean from 1 mile off Corner Camp to Hut Point to fetch help for the Second Return Party. The time of Crean's walk and respective wind velocity is indicated on Fig. 10.3. If a lone man, having done 1200 miles, could make a thirty-five mile solo journey with "a little chocolate and biscuits,"[53] why two *rested* men could not dog sledge in the opposite direction at the same time is difficult to explain, without the notion of sloppiness or downright disregard to Captain Scott's orders.

Tom Crean – an unsung hero[54] – started his rescue mission on Feb. 18th at 7:30 a.m., and according to Lashly's diary "Crean sailed away in the splendid weather for a try to bring relief".[55] Let us compare the "splendid weather" at Corner Camp with the simultaneously recorded wind velocity at Cape Evans. A brief consultation of Fig. 10.4, where I indicated by a black arrow and number 3 the Tom Crean journey period, indeed confirms that the previous gale was abating and a brief period of low wind velocities was setting in. This observation further confirms that Dr Atkinson could but did not sledge on Feb. 18th toward Corner Camp. This also confirms that during Feb. 14th and 15th, Dr Atkinson and Dmitrii could significantly advance in the desired direction to meet Captain Scott and the Second Returning Party.

Crean was fortunate to finish his journey to Hut Point just before the gale resumed (most probably a blizzard). According to Dr Atkinson, it was impossible to travel until 4:30 p.m. on Feb. 20th, and after departing with two dog teams and Dmitrii, they sledged for 24h with only one rest for the dogs to reach Corner Camp, where they spotted the flag indicating the location of the Teddy Evans and Lashly tent.

During this particular time period, from 4:30 p.m. Feb. 20th to 4:30 p.m. Feb 21st, the wind velocity at Cape Evans was, as depicted on Fig. 10.3, at gale and above strength. Yet surprisingly, it was possible to dog-sledge. After finding Teddy Evans and Lashly, the party turned back and

> At 3 A.M. on the morning of the 22nd we made a start, Evans being in his sleeping-bag on the sledge. The teams travelled well, and with only one break 15 miles from Hut Point we reached home and safety for him at midday, after 5 hours' actual travelling.

Meeting the Second Return Party and especially Lt Evans who was affected by scurvy virtually meant the end of Dr Atkinson's attempt to meet the polar party.

However, was it the right response to the situation? I think that Dr Atkinson's change of plans of not meeting Captain Scott in order to stay with Lt Evans was a lame excuse. All the previous actions of Dr Atkinson confirm that he was delaying his departure as long as possible. He started to sledge south, but only when the ice between Cape Evans and Hut Point was on the verge of breaking. After arrival at Hut Point, despite the weather permitting sledging, he stayed at the hut.

Dr Atkinson changed his plan on the premise of his duties as a physician. At the time of his judgment, he must have considered the relationship between the Hippocratic Oath and Captain Scott's orders. However, was it right that instead of being a physician he became a nurse? No. The Hippocratic Oath does not speak about nursing patients. It speaks about prescribing "regimens for the good of my patients according to my ability and my judgment and never do harm to anyone". The physician is responsible for "prescribing regiments," and not for nursing, or, for example, financing the purchase of prescribed regiments.

Lt Evans had scurvy, and Dr Atkinson should know that no special "regiments" were available then or even today. The only prescribed regiment was a food containing vitamin C. Dr Atkinson was fully aware of scurvy symptoms and treatment. He *lectured* on scurvy at Cape Evans on Aug. 17th, 1911. For treating scurvy symptoms like "mental depression, debility, syncope, petechiæ, livid patches, spongy gums, lesions, swellings, and so on to things that are worse,"[56] a good nurse or just a common sense (instructed) fellow explorer will do to comfort Lt Evans who was a sturdy man. Thus for Lt Evans, the only required treatment was a resumption of normal vitamin C intake in consumed food. Everyday meals prepared by the expedition cook Thomas Clissold were sufficient for Lt Evans' recovery, supported by "lime juice" as Dr Atkinson observed during his lecture.

Dr Atkinson withdrew from the sledging journey to meet Captain Scott's party, thereby creating the next chain of uncommon and hard to understand events. One thing is certain – Dr Atkinson considered what would be best for him[57]

> Considering his [Evans' – KS] condition, I judged that if I were able to obtain help from Cape Evans it would be better for me [*sic*] to stay with Lieutenant Evans and for Wright or Cherry-Garrard to take my place with the dog teams and to go south with Demetri [Dmitrii].

Curiously, that is the only consideration which Dr Atkinson presents. However, if he was so concerned with Teddy Evans' condition, why was he not concerned with the Captain Scott party's condition, which had spent much more time on the same food, exposed to the elements and steadily decreasing temperatures as the Antarctic winter was approaching? Not a word.

Tab. 10.2 lists the names of fellow explorers who would have been available to Dr Atkinson in his decision to choose between Wright or Cherry-Garrard to replace him and sledge to meet Captain Scott party. Dr Atkinson does not describe his reasons for his selection of Wright or Cherry-Garrard. Did Dr Atkinson consider for example Tryggve Gran, Patrick Keohane, or Frederick Hooper?

Indeed, the suggestion and/or selection by Dr Atkinson of Cherry-Garrard to sledge to meet the Captain Scott party was by all means the worst possible decision.

Cherry-Garrard had none of the qualities which would qualify him to join the *Terra Nova Expedition*, apart from cash to buy in. He supposedly could not navigate, learn how to navigate, and use a compass to navigate. At best, Cherry-Garrard was suited to write the next issue of *The South Polar Times*, but not venture onto the Barrier. The Captain Scott party's well-being was hanging on Cherry-Garrard's supposedly nonexistent sledging and navigating talents.

I formulate the above comments without *post factum* knowledge (hindsight bias). One must remember that during these actual events after Dr Atkinson's decision to not continue his journey to meet Captain Scott, the One Ton Depôt was still short of 2 X.S. units. This meant that if Captain Scott returned before he had originally planned, he and his party could have starved to death, since not enough food for them was left at One Ton Depôt.

Why did no one at Cape Evans and Hut Point feel the urgency in ensuring that the food ordered by Captain Scott would be there before Jan. 19th, 1912? What if the Captain Scott party, one week after splitting with the Second Return Party, was forced to turn back? What if, before splitting with the Second Return Party, Captain Scott ordered all of them to return?

Many more scenarios can be added to the above one to emphasize the uncertainty and the extraordinary lack of action by the home party. Obviously, Dr Atkinson by ordering Gran or Wright to sledge south could ensure or at least substantially increase the possibility to delivering food to One Ton Depôt.

At that time, Gran was perhaps the most skilled person at Cape Evans. He could easily and with great efficiency dog-sledge with Dmitrii. To my knowledge and understanding, the pair of Gran-Dmitrii was the best and perhaps the most efficient in dog sledging. Even the pair of Meares-Dmitrii could not match its efficiency, since Gran instead of sledging the Russian style could ski along, thus saving the weight of sledge for additional provisions to be carried. However, one would only guess that for Dr Atkinson, Gran's foreign origin crossed out his name from active participation in the mission.

Neglecting without apparent reason Keohane and Hooper to participate in the sledging journey to meet Captain Scott, Dr Atkinson suggested that Wright or Cherry-Garrard should replace him.

Since the actual events in late February 1912, a long debate has ensued about Dr Atkinson's selection of Wright and Cherry-Garrard to lead the mission to meet Captain Scott and his party. Unfortunately, this debate was highly superficial and only accounted for selected events. To decide the question of who should replace Dr Atkinson without a broader understanding of the actions of the different fellow explorers may lead to hasty conclusions.

I already mentioned and stressed that the *Terra Nova Expedition* was not a leisure escapade to the Antarctic. Throughout the expedition, one could account for many acts of courage, sacrifice, and unrestricted readiness to help each other. Just let me name a few such events: Tom Crean's solitary walk to Hut Point, the winter trip to Cape Crozier (Dr Wilson, Lt Bowers and Cherry-Garrard), and of course, Captain Oates' act of self-sacrifice. These acts were premeditated actions, and will remain in the annals of exploration.

Indeed, how to explain the above-mentioned actions by Dr Atkinson and Dr Simpson. At the most important time for the outcome of the expedition, Dr Simpson washed his hands of the whole affair, and under dubious circumstances

left the Antarctic. Dr Atkinson, under a false and trumped up need of taking care of Lt Evans, dumped his already late attempt to meet and deliver food rations for the Captain Scott party.

Let me continue, and assume that Drs Atkinson's and Simpson's actions were not biased and tainted by tacit mutiny. When the question arises of who instead of Dr Atkinson should continue his mission, one must think that Charles Wright (Silas) out of all Cape Evans personnel was the most suited to go south. He was capable of navigating, he was strong, and he was acquainted with dog sledging. However, these obvious qualities did not prevail, and the supposedly unable to navigate, unable to drive dogs, and short-sighted Cherry-Garrard was selected.

The selection between Wright and Cherry-Garrard was made by Dr Atkinson, who *post factum* accounted that[58]

> Having regard to his work, it was better that Wright should not take command of the dog teams, and so it was settled that Cherry-Garrard should do this.

His account was in line with Cherry-Garrard's[59]

> Wright and I started for Hut Point by 2 p.m. the same day and on our arrival it was decided by Atkinson that I was to take out the dogs. Owing to the early departure of our meteorologist, Simpson, Wright, who had special qualifications for this important work, was to remain at Cape Evans.

However, Wright's account was rather different[60]

> But Simpson, who had been left by Scott in charge [*sic*], demanded my body in order to carry on his work during the second winter, leaving the One Ton journey for Cherry and Demetri [Dmitrii].

The investigative reader right away starts to wonder what "special qualifications" Charles Wright had, and why was he not replaceable. Indeed, Wright was a university educated physicist and fine fellow explorer. While at Cape Evans, he was assisting Dr Simpson in taking meteorological observations, as I described in Chapter 6. Recording standard meteorological observables (temperature, minimum daily temperature, pressure, wind velocity and direction), which amounts to serving as a glorified recording device, is not a difficult assignment. Anyone able to read and write could easily record these variables. Alternatively, Dr Simpson and Wright in a short time could train someone at Cape Evans to take meteorological observations.

Therefore, it is hard to believe that Wright was the only person at Cape Evans (see Tab. 10.2) who could record meteorological data. What about Dr Atkinson, who stayed at Cape Evans? However, why did Dr Simpson not stay at Cape Evans to support his fellow explorers and Captain Scott? If Dr Simpson was *really* concerned, he would stay and continue the meteorological work. But he was not concerned.

One would think that there was an easy choice between continuing meteorological measurements and delivering food and fuel desperately requested by Captain Scott. Was not the life of Captain Scott and his party directly dependent on the delivery of supplies to One Ton Depôt?

The above cited accounts of reasons for selecting Cherry-Garrard over Wright to go south to meet Captain Scott are disturbing, especially Wright's account in which he says that he did not go south because of Dr Simpson, who apparently "demanded"

that Wright stays at Cape Evans in late February 1912 “to carry on his work during the second winter”. Indeed a strange explanation. Even this request was not achieved, as the hourly temperature record at Cape Evans was ended without explanation on the last day of August 1912![61] Wind measurements were finished a month later.[62] That alone is scientific misconduct for not continuing elementary measurements for about 6 months. The investigative reader may recall Dr Simpson told us that he would “have longed to be able to show the result [three volumes of meteorological data] to Captain Scott”.[63] However, if this somehow happened, I can only presume that Captain Scott in a transcendental way would ask Dr Simpson why the measurements were not continued, and why he did not address this question while commenting[64]

> *‘Terra Nova’ Expedition, Cape Evans, 1911–12*. – There is a complete set of hourly data for the period February, 1911, to August, 1912. In addition, observations of daily maximum and minimum temperatures are available for 18 days in January, 1911, and for the remainder of 1912 after the end of August. [*sic*]

After the decision was taken that Cherry-Garrard and Dmitrii would dog-sledge south, it is interesting to notice how throughout this time the purpose of sledging was changing:

- Meares and Dmitrii were supposed “to meet the returning party about March 1 in Latitude 82 or 82.30”[65],
- Atkinson was supposed to “with the depot [of dog-food] which has been laid come as far as you can”[66],
- Atkinson and Dmitrii were supposed “to hasten the return of the final party”[67],
- Cherry-Garrard “… it was better that Wright should not take command of the dog teams, so it was settled that Cherry–Garrard should do this”[68].

From the above, one can see how Captain Scott’s original order given in writing to Meares and Dr Simpson was changing, and indeed gradually dissolving. The participants in the process were finding excuse after excuse for not launching a full rescue (relief) action.

Besides Captain Scott’s order which was not followed, one must be really alarmed by the state of Lt Evans. The lack of response by fellow explorers at Cape Evans/Hut Point to it is extraordinary and telling. Additionally, one could think that after all of the above-mentioned chaos with responsibilities and commitments, the situation would settle and Cherry-Garrard would indeed attempt to reach the Captain Scott party. Nothing could be more wrong than that. In Chapter 2.3, I already presented and discussed how the First Relief Party’s (Cherry-Garrard and Dmitrii) attempt was only a façade. Let me here add some more points which will entirely confirm my previous conclusions.

10.4. Apsley Cherry-Garrard and Edward Atkinson

In the chapter titled *Suspense*, Cherry-Garrard describes the efforts of various individuals in February and March 1912. After describing Dr Atkinson’s attempt, he presents his estimation that his First Relief Party’s “opportunity to reach One Ton

Camp before them [Captain Scott's party – KS] had been lost". The causality on which he is making this judgment is stunning and shocking to one who recalls that no food worth mentioning was left at One Ton Depôt, and thus Captain Scott would starve to death. Let Cherry-Garrard speak for himself[69]

> Taking into consideration the advanced latitude, 87°32′S., at which the Second Return Party had left Scott, and the extremely good daily averages these two parties had marched on the plateau up to this point, namely 12.3 geographical miles a day [*sic* 11.2 miles/day]; seeing also that the First Return Party had averaged 14.2 [*sic* 13.1 miles/day] geographical miles on their return from 85°3′S. to One Ton Depôt; and the Second Return Party had averaged 11.2 geographical miles [*sic* 13.4 miles/day] on their return from 87°32′S. to the same place, although one of the three men was seriously ill; it was supposed that all the previous estimates made for the return of the Polar Party were too late, and that the opportunity to reach One Ton Camp before them had been lost. Meanwhile the full rations for their return over the 140 miles (statute) [= 121.66 geographical miles – KS] from One Ton to Hut Point were still at Hut Point.

From the above lengthy citation, one can see that all of Cherry-Garrard's estimations of the daily velocity of various sledging parties were wrong. These false estimations led Cherry-Garrard to conclude that at the moment of his departure from Hut Point, Feb. 26th, 1912, "the opportunity to reach One Ton Camp before them had been lost". Indeed, I have no idea how Cherry-Garrard arrived at his velocity estimations. Surely one could make wild guesses. However, there is no need for that, since Cherry-Garrard's math does not hold water.

In Chapter 2.3, I analyzed various scenarios of the possible dates of Captain Scott's arrival at One Ton Depôt. It was shown there that Cherry-Garrard's expectations to meet Captain Scott at One Ton Depôt were entirely unjustified and unfounded. That was to confirm that the First Relief Party's journey was a façade. But not only Cherry-Garrard's actions confirmed that miserable founding. It appears that Dr Atkinson actively participated in camouflaging the tacit mutiny, and unveiled his deceit by preventing anyone to rush with a relief (rescue) journey to meet Captain Scott's party.

It is indeed distressing to read Dr Atkinson's account how the First Relief Party was planned. Here is the exact account[70]

> After due consideration of weights and the probabilities of the date by which the final party could return to certain depots, it was decided that the dogs should take 24 days' food for themselves and 21 days' food for the two men, carrying in addition two weeks' surplus supplies for the Southern Party complete and certain delicacies which they had asked for. The totals brought the weight carried by each team up to the most economical travelling limit for the time of year.

Dr Atkinson's above explanation is the most curious and odd account possible. I admit that after spending a very long time analyzing the logistical aspects of the *Terra Nova Expedition*, I do not understand the possible rationale behind Dr Atkinson's account.

I discussed earlier the range of self-sustained dog sledging. It was shown using a conservative estimation, such a self-sustained range is about 800 miles. This dis-

tance can be converted into dog sledging days, and if one assumes a very conservative daily velocity of 10 miles/day, it translates into a minimum of 80 days of self-sustained dog sledging.

Dr Atkinson's line "After due consideration of weights and the probabilities" may sound to an inexperienced reader like a convincing case. However it is pure nonsense, especially as it is directed to the Cherry-Garrard party, and especially when Dr Atkinson is not supporting his account by numbers. The analytically minded reader may ask what was the probability that the Captain Scott party would reach One Ton Depôt on say Mar. 10th, 1912. Of course, no one could calculate such probability now as well as back then, as the meaning of probability is and was different than what Dr Atkinson is trying to convey.

Without specification of locations and distances, Dr Atkinson is telling us that the First Relief Party by carrying 3 weeks of provisions for themselves and 2 weeks of rations for the returning Captain Scott party was operating in "the most economical travelling limit for the time of year". By adding "certain delicacies which they had asked for," Dr Atkinson is trying to persuade the reader that Captain Scott's orders and additional reminders were more than fulfilled.

It is incredible how twisted Dr Atkinson's account is. He introduces concepts of probability and economy of sledging as if these notions were applicable in the situation under consideration. He is appealing to the notions of probability and economy as if Cherry-Garrard and Dmitrii were travelling regularly between two locations in England. Nothing cannot be more hypocritical. The investigative reader may notice a parallel between Dr Atkinson's false probabilistic account and a similar probabilistic fallacy of the *Extreme Cold Snap* made by Dr Simpson and Dr Solomon.

The First Relief Party, Cherry-Garrard and Dmitrii, was on a life-threatening mission not only for themselves, but for Captain Scott's party. If for any reason the party did not reach One Ton Depôt, it was certain that Captain Scott's party would perish due to starvation. Thus, deciding without a contingency plan that Cherry-Garrard – a man who "had never driven one dog, let alone a team of them," and "knew nothing of navigation" to be dispatched to "One Ton [which] was a hundred and thirty miles away, out in the middle of the Barrier and away from landmarks," is inexplicable and reckless, unless Dr Atkinson was acting in bad faith.

In section 2.3, I presented a detailed analysis of the actions of the First Relief Party from the weather point of view. I described there that while at One Ton Depôt, the party could sledge southward despite the occasional prohibiting weather, and by stretching food rations or speeding up, Cherry-Garrard could meet the Captain Scott party. This is contrary to Cherry-Garrard's account that[71]

> Since there was no depôt of dog-food at One Ton it was not possible to go farther South (except for the one day mentioned above) without killing dogs.

Evidently Cherry-Garrard forgot, if he was fair-minded, that the dogs staying put at One Ton Depôt were also eating their food rations. Since he originally carried out 21 days food rations for the dogs Cherry-Garrard must have assumed that the dogs, weather permitting, could travel for 21 days.

However, since Dr Atkinson allocated *only* 21 days dog and 24 days human rations, he immediately limited the range of the First Relief Party. Dr Atkinson's economical argument for weights must be overthrown, and the question must be asked

why Cherry-Garrard dog sledging was limited to 24/21 days instead of at least 80 days, as discussed above. At least theoretically, Cherry-Garrard could dog-sledge one way for 40 days, and assuming a sledging velocity of 10.1 miles/day for Captain Scott's party, he and Dmitrii could reach the Beardmore Glacier (say –83.7333) and return to Hut Point. That is the *lower* bound of the range of self-sustained dog sledging range.

Indeed, one would suggest that Dr Atkinson miscalculated or misjudged the amount and time needed for the Cherry-Garrard and Dmitrii party. However, I do not think that this was the case. Dr Atkinson was making cover up decisions to mask the inaction of fellow explorers at Cape Evans/Hut Point. To prove someone's intentions is a difficult task. However, based on the circumstantial evidence presented above, one may assume that Dr Atkinson's "actions" were only a smokescreen, since no one at home base was interested in risking his own life to support the Captain Scott party.

In order to further support the above, let me append two additional circumstances where Dr Atkinson produced false and fallacious arguments. In his account of meeting the Polar Party, and while describing the journey of the First Relief Party, Dr Atkinson commented[72]

> On March 10 they depôted their two weeks' supply of provisions for the Southern Party, including several smaller delicacies [*sic*]. One Ton was then supplied with sufficient man provisions for a party of five for over a month [*sic*].

Sadly this is not true. We know from previous analyses in the current chapter that 1 X.S. food ration was one week's rations for four men. Since Cherry-Garrard deposited at One Ton Depôt 2 X.S., it meant that Captain Scott's party had 2 X.S. plus ⅓ X.S. left rations for 5 people to get them to Hut Point. Altogether 2⅓ of X.S. should keep the 5 man Captain Scott party going for exactly *two weeks time*, and not "for over a month" as written by Dr Atkinson to convince the readers that because of his actions One Ton Depôt was indeed oversupplied with food.

But Dr Atkinson not only wanted to convey to the readers that he was doing his utmost to deliver a surplus of food, but also that he was carying so much for Captain Scott's party that even "several smaller delicacies" were delivered by Cherry-Garrard to please the returning party.

Thinking in terms of February/March 1912 knowledge available to Dr Atkinson and Cherry-Garrard, Captain Scott's party did not need "delicacies" it needed support. Since Lt Evans had scurvy, Dr Atkinson instead of "delicacies", should have supplied One Ton Depôt and hence the Captain Scott party with seal meat (in particular seal liver). Certainly not a delicacy but acknowledged by all as a source of vitamin C.

Moreover, as I discussed in section 2.3, Dr Atkinson ascribed to Cherry-Garrard obscure explanations of staying put at One Ton Depôt from Mar. 4th through Mar. 10th.

Let me recall that Cherry-Garrard with Dmitrii left Hut Point on Feb. 26th, 1912 at 8:30 a.m., and arrived at One Ton Depôt Mar. 3rd, 1912 at 5:45 p.m.[73] Therefore they sledged for 7 days covering 118 miles, which gives 16.9 miles/day. While returning, they left on Mar. 10th, 1912 at 1:45 p.m., and arrived at Hut Point on Mar. 16th, 1912, which gives 6 sledging days and velocity of 19.7 miles per day.

If instead of sitting in the tent and wondering about possible excuses (non-existent bad weather, non-existent continuous blizzard, irrelevant lack of dog food, non-existent inability of navigating, Dmitrii's non-existent illness, waiting for Captain Scott's

party) for not sledging southward, Cherry-Garrard guided by gumption and compassion continued south on Mar. 4th with his up to this moment sustained velocity of 16.9 miles/day, he could advance at least for a couple sledging days. The development of such situation is depicted in Fig. 10.5. On this figure, the actual (and unknown to Cherry-Garrard) Captain Scott party sledging distances are shown, together with two hypothetical sledging distances. One for Captain Scott sledging under the assumption of the originally envisioned 144-days sledging plan (10.1 miles/day), and the second one for Cherry-Garrard dog sledging with 16.9 miles/day.

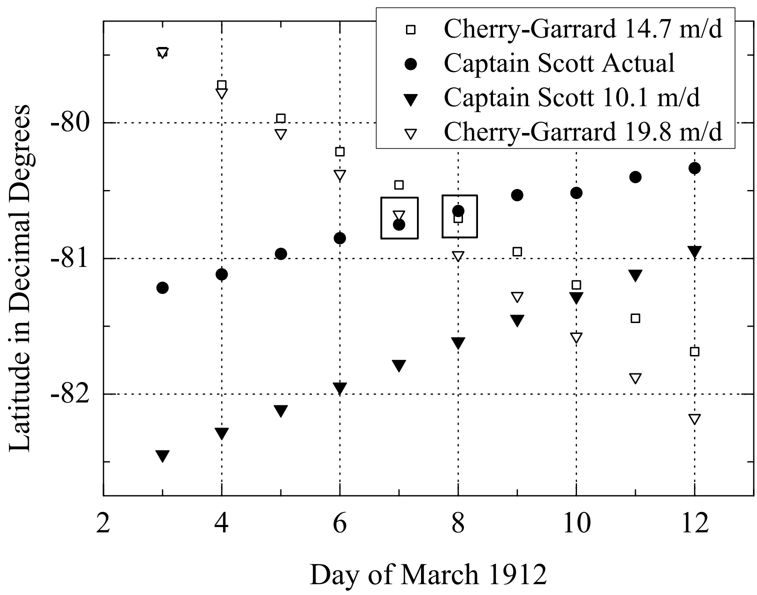


Figure 10.5. Actual latitude (●) of Captain Scott's party in March 1912. Possible latitudes of Captain Scott's party (▼) resulting from the 144-days original sledging journey, and sledging latitude of a hypothetical Cherry-Garrard journey southward (□) and (▽) calculated using his average dog sledging velocity from Hut Point to One Ton Depôt (16.9 miles/day) and One Ton Depôt to Hut Point (19.7 miles/day), respectively.

Under the described conditions, Cherry-Garrard could expect to run across Captain Scott's party on about Mar. 10th. Obviously, it was too late for him to venture that far and safely return to Hut Point. However, if he decided to run on not full rations for men and dogs, or sped up his daily sustained sledging mileage, then it would have been practical to stretch his south journey even until Mar. 10th. He could also think, based on previous accounts of dog sledging velocities, that his return would be faster than 16.9 miles/day. In fact, this is precisely what happened during his return from One Ton Depôt, when the average sledging velocity was 19.7 miles/day.

He could also not make any pre-emptive decisions and just sledge south. Fortunately, because of this gumption he could have been satisfied and honored to meet the Captain Scott party on Mar. 7th/8th, and change history. None of that happened, and only superfluous quibbles were made by Cherry-Garrard and Dr Atkinson.

An additional instance of Dr Atkinson's exaggeration was already mentioned in section 2.3 and was related to the actions of the Second Relief Party (Atkinson and Keohane). Several days after Cherry-Garrard and Dmitrii's return, Dr Atkinson finally noticed Keohane's presence and observed,[74] "that something had to be done, I proposed to Keohane that he should come out alone with me." On Mar. 26th they left Hut Point and man-hauled towards Corner Camp. Despite the fact that new and fresh dogs had arrived on the *Terra Nova*, both Dr Atkinson and Keohane did not know how to dog sledge. After 4½ days of travelling and a few miles from Corner Camp, Dr Atkinson observed[75]

> Taking into consideration the weather [*sic*] and temperatures [*sic*] and the time of the year [*sic*], and the hopelessness of finding [*sic*] the party except at any definite point like a depôt, I decided to return from here. We depôted the major portion of a week's provisions to enable them to communicate with Hut Point in case they should reach this point. At this date in my own mind I was morally certain [*sic*] that the party had perished, and in fact on March 29 Captain Scott, 11 miles south of One Ton Depôt, made the last entry in his diary.

We already know that Dr Atkinson was capable of formulating arguments which on the surface appeared to be sound, but with a minimal scrutiny were revealed to be pointless. The above expound was written and printed in the second volume of the first edition of Captain Scott's journals in 1913. Therefore, it is not an original journal written during the events.

The first line consists of two meteorological and time variables, which in Dr Atkinson's presentation appear as constants. The weather is variable, and at given moment of time it may force the party to pitch a tent, but eventually after a variable time the weather may enable one to continue sledging. The same applies to temperature and its variability. Therefore, temporary bad weather cannot permit one like Dr Atkinson to turn back. Just imagine Captain Scott turning back during (or after) the gale at the foot of Beardmore Glacier in December 1911.

Dr Atkinson makes also reference to "the time of the year". Indeed, he is saying that the winter was rapidly approaching, and hence he should turn back. However, Dr Atkinson by bringing up the time of the year as an excuse to return entirely forgot that Captain Scott's party in its original 144-days plan was expecting to be sledging until Apr. 1st, 1912 (see section 2.3; Nov. 3rd, 1911 + 4 days blizzard ≈ Apr 1st, 1912 at Cape Evans). If Captain Scott was expecting to sledge on this date after sledging for 1490 miles, why suddenly was this "time of the year" too much for the rested Dr Atkinson?

Let us continue reading Dr Atkinson's rationale to turn back. Dr Atkinson's "hopelessness of finding" Captain Scott's party "except at any definite point like a depôt" sounds very unconvincing. The first problem with Dr Atkinson's argument is that it is illogical. Since according to Dr Atkinson it was possible to meet the party only at a depôt, he should have concluded that finding Captain Scott was not entirely hopeless. However, much more important is the fact directly experienced by Dr Atkinson that each sledging party was following the previous party's wake. It resulted from the parties sledging between depôts and because the parties were using compasses as requested by Captain Scott to guide their sledging effort. Let me recall Captain Scott's order that[76]

> Every officer who takes part in the Southern Journey … ought to know what the true course is to reach one depôt from another.

Therefore, it was unlikely but not entirely impossible that while sledging the party would substantially deviate from an imaginary straight path connecting depôts.

Dr Atkinson's last and most disturbing account is his rationale of moral issues. It is indeed terrifying to read Dr Atkinson when he argues that

> At this date [Mar. 30th – KS] in my own mind I was morally certain that the party had perished

and supports his moral certainty by the fact that

> on March 29 Captain Scott, 11 miles south of One Ton Depôt, made the last entry in his diary.

Hence, Dr Atkinson makes a mixture of moral and hindsight issues. Let us discard the former, and look at what Dr Atkinson may have thought on Mar. 29th, 1912, just a few miles of Corner Camp. Was there anything to allow him to be "morally certain" that Captain Scott and his party was by Mar. 30th already gone? I think that on Mar. 30th, 1912 there was nothing certain, literally nothing. Moreover, there was no need to involve morality and other highly speculative notions. Simple math would suffice.

Let us recall that Captain Scott's original plan was to sledge for 144 days from Hut Point to the South Pole and back. Since it takes 3 sledging days to reach Corner Camp from Hut Point, Captain Scott should have been there after 141 sledging days. However, because of the 4 days blizzard delay in December 1911, Dr Atkinson should have expected the Captain Scott party to reach Corner Camp after 145 days of sledging, that is on Mar. 27th.

Thus according to Dr Atkinson's morality, 3 (three) days delay at Corner Camp after 145 days of sledging was sufficient for his moral certainty that the Captain Scott party had perished. Just imagine yourself waiting at the airport, and noticing that the airplane caring your relative did not arrive after a ~2% delay of the scheduled flight time. Would anyone start to be morally certain that the plane has crashed? Of course not. It would be insane to think like that.

But Dr Atkinson evidently thought like that. He is saying that a just over 2% delay in returning is sufficient to assume that the Captain Scott party perished in the vast Barrier icy territory. Pure nonsense and hypocrisy.

The investigative reader at this moment could raise the argument that indeed the First and Second Return Parties sledged homeward at a velocity faster than what was assumed in the Captain Scott plan. Indeed it was the case, as clearly depicted in Fig. 2.3.

However, what could one assume about the Captain Scott party knowing (though Cherry-Garrard got it entirely wrong) the approximate return velocities of the First and Second Return Parties, which indeed sledged faster than the 144-days plan and the resulting 10.1 miles/day? Dr Atkinson could find a number of contrary arguments.

One could argue that the observed "home going" increase of velocity in the case of the First and Second Return Parties should be also observed for Captain Scott's party. However, another one after noticing how incapacitated by scurvy Teddy Evans

was, could argue that since Captain Scott's party was much longer exposed to factors causing scurvy, it velocity was affected by possible health problems and thus with a much slower velocity than expected.

On Mar. 30th, 1912 no one, including Dr Atkinson, could rightly and accurately speculate the time when the Captain Scott party would arrive at Corner Camp or at any other location. By speculating, I mean to make an educated calculation/estimation. The aforementioned arguments of Captain Scott's possible sledging velocities were conflicting and not separable, thus no educated estimation was possible. However, this inability to obtain an educated guess did not prevent anyone from sledging and looking for Captain Scott and his companions.

Therefore, Dr Atkinson's moral certainty was a hindsight invention to camouflage and justify his real reasons for turning back on Mar. 30th. We will never know those reasons for certain. However, Dr Atkinson's unwillingness to launch a real relief expedition represented a continuation of the previous lack of real action by Meares, Dr Simpson, and Cherry-Garrard.

10.5. Historical Scrutiny

In the proceeding sections of this chapter, the multi-layered maze of an explorer's actions and writings was presented. One should notice that all information and data were taken from the original sources, the expedition members themselves. The latest dated sources were the books of Cherry-Garrard[77], published in 1922, and Captain Evans[78], published in 1921. Along with the two volumes of Captain Scott's journals, the above-presented observations, comments, and conclusions are readily apparent to anyone. Captain Evans' inclusion of the original orders written to Meares and Dr Simpson was especially helpful. This basic information was easily accessible, without having to visit and dig into the archives of the unhelpful Scott Polar Research Institute in Cambridge.

By attaching Captain Scott's orders in his book, Captain Evans threw significant light on important and practical issues of the *Terra Nova Expedition's* organization. One would also appreciate Captain Scott's thoughtfulness in putting his orders in writing. Thanks to them, interested readers have easy access to valuable information.

Unquestionably, reading Captain Evans' book is an absolute minimum for anyone interested in the subject. After all, he was the second in command for a good part of Captain Scott's expedition, and therefore his voice must be accounted for.

While looking at his role in the *Terra Nova Expedition*, one inevitably arrives at a perplexing question: why was the then Lt Evans, the second in command of the *Terra Nova Expedition*, not ordered to stay and take charge of Cape Evans during Captain Scott's absence during the South Pole Journey? Staying in command at Cape Evans may not have been as attractive for him as sledging with Captain Scott toward the Pole, but from the perspective of the *South Pole Journey* it was absolutely fundamental that the people's movements and actions at Hut Point/Cape Evans were as Captain Scott expected (ordered).

Subsequently, an even more intriguing question arises: after returning with the Second Return Party, why did Lt Evans not assume command at Cape Evans? Indeed, it is true that upon his return at Hut Point/Cape Evans he was seriously

affected by scurvy. However, it is equally true that as far as scurvy is unpleasant, painful, and if untreated terminal, it does not take away the intellectual power of the affected person. Therefore, even if affected by scurvy, Lt Evans was at complete mental competence.

From the analysis presented in this chapter, we know that upon Lt Evans' return, he would have found Cape Evans in disarray. Most interestingly, he would have noticed that Captain Scott's orders issued to Meares, and more importantly to Dr Simpson, were not being followed. Although the orders to Dr Simpson had a good number of particularities, what would have been apparent was that Dr Simpson had mutinied and on dubious arguments was returning home. Dr Simpson was nominated by Captain Scott to be in charge of Cape Evans' operation. Since he was leaving his post without authorization, could Lt Evans, as the *Terra Nova Expedition*'s second-in-command, order him to return from the deck of the *Terra Nova* back to Cape Evans? My intuition tells me that together with the *Terra Nova*'s commander, Lt Harry Pennell, he could effectively pressure Dr Simpson to resume his post at Cape Evans. Alternatively, if Lt Pennell and Lt Evans could not order or persuade Dr Simpson to resume his command of Cape Evans, they should have made a record of this disobedience for further in-depth investigation in a "court-martial" like procedure, and then arrested him. None of that happened, and the *Terra Nova* caring Lt Evans, Meares, and Dr Simpson "in silence" sailed off from Cape Evans.

Lt Evans must have felt that Captain Scott had been in various ways tacitly biased against him and his second-in-command position. Indeed, Captain Scott's letter to J. J. Kinsey – his New Zealand manager from the *Discovery Expedition* days – written just a few days before the South Pole Journey began, revealed his true feelings[79]

> I have little but the highest praise for everyone here. I am surrounded by men whom I can thoroughly trust. Wilson is positively splendid, Bowers a perfect treasure, Oates, Cherry-Garrard, Wright and the rest, are not far behind.
>
> Teddy Evans [Lt Evans – KS] is a thoroughly well-meaning little man, but proves on close acquaintance to be rather a duffer in anything but his own particular work. All this is *entre nous* [in confidence – KS], but he is not at all fitted to be 'second-in-command', as I was foolish enough to name him. I am going to take some steps concerning this, as it would not do to leave him in charge here in case I am late [*sic*] returning.

It is an odd account, not because Captain Scott is praising his comrades, but because of his last ambiguous line about an unclear relationship between his return time and Lt Evans not being in charge at Cape Evans. The investigative reader already knows Captain Scott had a 144-days sledging plan. This plan was not only distributed in time, but also in the temporary distribution of food/fuel rations along the return route; meaning that Captain Scott's party must arrive at depôts at certain regularities. Thus, a one-day late return, measured as a departure from the 144-days sledging plan, meant one day without food/fuel. A two-days late return meant two days starvation or sledging on half rations, and so on. Thus, the Captain Scott party's margin of late return was indeed very narrow; I would imagine just a few days, especially during the final miles to Hut Point when the party had already sledged for so many miles. It appears that this particular comment by Captain Scott was an unsubstantiated excuse,

and that the real reason for not letting Lt Evans be in charge was a shocking display of irrationality.

What Captain Scott meant by his judgment was detailed in an expurgated and irrational passage from his diary entry for May 5, 1911[80]

> Evans himself is a queer study – his boyish enthusiasm carries all along till one sees clearly the childish limitations of its foundation and appreciates that it is not a rock to be built upon – He is altogether a good fellow and wholly well meaning but terrible slow to learn and hence fails altogether to grasp the value of any work but his own – very desirous to help everyone he is mentally incapable of doing it – There are problems ahead here for I cannot consider him fitted for a superior position – though he is physically strong and fit for a subordinate one. It was curious to note how his value (in this respect) suddenly diminished as he stepped onshore – The ship's deck was his named? position – on the land he seems incapable of expanding beyond the limits of an astonishingly narrow experience.

Indeed, it is a crazy judgment of a man who had already been successful in fundraising efforts, a role well outside his naval career and requiring being on shore. It becomes even more crazy with the future knowledge that Lt Evans would be knighted, reach full Admiral, serve with distinction in both world wars in a variety of roles, and end up being made a peer.[81] If his full versatility extended back to 1911, then Captain Scott's judgment was deeply irrational. How could this irrational judgment have happened?

The most likely explanation is a simple personality conflict. Captain Scott, famed for his self-control, could only have had his gears grinded by Lt Evans' impulsiveness causing him to commit *faux pas* like suddenly mentioning his disturbing interest in nocturnal emissions during polar expeditions in a speech at a Royal Navy hospital (see section 5.2). I wonder if Lt Evans made the mistake of asking Dr Atkinson about this interest – within earshot of Captain Scott?

What was even more irrational than this judgment was how Captain Scott changed his plans in response to it. For the role of being in command of Cape Evans he picked Dr Simpson, a man he had passed a similar judgment on in other expurgated passages in his diary as "inclined to keep his eyes aloft and blind to surface values … [in] want of worldly wisdom …"[82] As if that was not bad enough, he then wrote detailed orders to both Lt Evans and Dr Simpson, leaving both of them with as little need for initiative as possible. Such a course would not have excluded Lt Evans from command at Cape Evans at all, and Captain Scott might as well have given him that command, leaving Dr Simpson to his meteorological duties. Yet the perfectly plausible was not to be, and Captain Scott appointed a future mutineer to command Cape Evans in his absence. This insane mismanagement marked a nadir of Captain Scott's leadership.

It appears that upon returning with the Second Return Party, Lt Evans washed his hands from all matters at Cape Evans in a resigned manner. However, years after this, he felt perplexed enough to attach to his book Captain Scott's long and otherwise not very descriptive orders, among them the orders to Dr Simpson. One could say that he did it for historical reasons. But I sense that the by then Captain Evans was discreetly confessing that he had *de facto* no authority, and thus had no power to stop the miser-

able and distressful events at Cape Evans. Had they forcibly stopped Dr Simpson from his mutiny, Lt Evans and Lt Pennell could have been court-martialed for mutiny themselves, given Captain Scott's irrationality and disfavour towards Lt Evans.

10.5.1. Huntford's Blunder

Roland Huntford's work *Scott and Amundsen* – later updated and republished as *The Last Place on Earth* – remains a basic historical account of both Captain Scott's and Captain Amundsen's expeditions. Huntford's book aroused mixed opinions, from great appreciation to entire dismissal. I am not intending here to review Huntford's work as it stands on its own. I only want to point out what I think is his biggest deceit in his whole account of Captain Scott *Terra Nova Expedition*. This deceit is directly related to Captain Scott's role in the events at Cape Evans in the early months of 1912.

In Chapter 33, titled *The Ultimate Defeat*, Huntford builds his arguments based on entirely false and contradictory assumptions (statements)[83]

> Behind him at Cape Evans, Scott had left voluminous [*sic*] and intricate orders. They contrived to destroy initiative, bind his subordinates and throw responsibility on to others. They were, in the vital parts, imprecisely phrased, and open to misinterpretations.

and just a few lines later Huntford observes

> … Scott had gone off without leaving final instructions [*sic*]

One readily observes Huntford's contradictory remarks when he firstly notices "voluminous orders" and then no "final instructions". From the preceding subsections of the current chapter, we know that Captain Scott was by his own standards excessively careful with regard to actions to be undertaken by fellow explorers at Cape Evans during his South Pole journey. Captain Scott not only left Dr Simpson in charge of Cape Evans, but he also made sure that Dr Simpson was "fully aware of my plans and wishes". Therefore, Dr Simpson knew his orders written by Captain Scott, but also he had knowledge of many details which were not put on paper.

However, after re-reading Huntford's comment concerning the situation at Cape Evans, one gets the feeling that Huntford was fully aware of Captain Scott's written orders. The above contradictory comments and the following lines taken from Huntford's book denoted by my *italics* confirm this notion[84]

> Moreover, the responsibility for *executing the orders* would shift as Simpson, left in charge at Cape Evans, handed over to the first Naval officer returning from the south
>
> Simpson expected Meares and the dogs back by December 15th. He remained in uncertainty until the 26th, when Day and Hooper arrived with the wholly unforeseen news that Scott was taking the dogs on further than originally intended. They might, as Scott put it in his *new orders* to Simpson
>
> On January 5th, Meares finally arrived with the dogs. *He had nothing to do except wait* for orders from the south.

Huntford's reference to "executing the orders," "new orders," and especially to "he had nothing to do except wait," which is a copy of Captain Scott's line in his orders to Meares in October 1911, strongly suggests that Huntford was very much aware of these directives. Despite that, he made a chain of counterfactuals to show that Captain Scott was an incompetent and unstable leader[85]

> Evans also carried a message from Scott changing the orders for the dogs yet again – for the fourth time [*sic*]. Meares now was to come out and meet Scott between 82° and 83°S., some time towards the middle of February [*sic*]. The ostensible purpose was to hurry him back in time to catch the ship … It was in any case a vital alteration to his plans. It was verbal. It bore the stamp, once more, of last-minute improvisation [*sic*]. Scott assumed that Evans would deliver it in time [*sic*].

The above citation is indeed final proof that Roland Huntford was fully aware of Captain Scott's written orders to Meares and others. That is a devastating conclusion, which one cannot dispute. I admit that due to this, I lost my faith in his work.

My conclusion that Huntford fabricated Captain Scott's *verbal order* to Evans comes from the simple observation that Captain Scott could not possibly give him such a nonsense order. Let me repeat that according to Huntford, Captain Scott gave a verbal order to Lt Evans requesting Meares[86]

> … to come out and meet Scott between 82° and 83°S., some time towards the middle of February.

Characteristically, Huntford's line is imprecise for the investigative reader who immediately wonders: according to Huntford, did Captain Scott request Meares to

- meet the Captain Scott party in the middle of February 82°S and 83°S, or
- depart from Hut Point in the middle of February to meet Captain Scott at 82°S and 83°S.

Either way, Huntford is incorrect. On the day of parting, Jan. 4th, 1912 (see Tab. 10.3), Lt Evans and his Second Return Party were about 613.5 miles away from Hut Point (see Fig. 2.3). It meant 60.7 days of sledging to reach the destination according to Captain Scott's original 144-days plan. Consequently, Captain Scott was calculating that the Second Return Party would reach Hut Point on about Mar. 5th.

Huntford's "new" orders from Captain Scott could not be delivered, and thus executed, before or on Mar. 5th, 1912. Consequently, if delivered on Mar. 5th to Meares, he could not possibly meet Captain Scott in the middle of March, or start to sledge in the middle of February to meet Captain Scott at 82°S and 83°S.

Therefore, Huntford's "new" order to Meares was a fabrication to discredit Captain Scott as a leader prone to "last-minute improvisation". However, on this occasion Captain Scott gave his orders in writing and well before they were supposed to be executed. Evidently, Huntford with a *post factum* knowledge added to the above cited verbal orders to Lt Evans that while issuing a "new" order to Meares "Scott assumed that Evans would deliver it in time". This line confirms that Huntford is suggesting that the order to Meares was to depart from Hut Point in the middle of February.

However, Huntford's assumption is *post factum* and wrong. Captain Scott, throughout the planning and execution of his South Pole journey, used the 144-days

sledging plan in all his calculations. I discussed some pertinent details of the 144-days plan in Chapter 9. In the following subsection, I will add additional arguments against Huntford's verbal orders to Meares. For now, I just add that Captain Scott reached location 82°S and 82.3°S. mentioned in the original orders to Meares almost exactly in line (4 days ahead of) with the 144-days plan.

10.5.2. Thoughtless History Re-writing

Captain Scott and his two expeditions, especially the *Terra Nova Expedition*, were not only cases of Captain Scott and his comrades' battle with the Antarctic environment, but also with human character and behavior. However, as I will discuss in the next chapter, Captain Scott's story has many layers from which one could examine it.

Throughout the pages of this book, I have been able to establish the outer layer of people not directly or even remotely related to Captain Scott's expedition. This layer is composed of those authors who contributed in various ways to understanding – or not understanding – Captain Scott and his Antarctica adventures by publishing a good number of books about Captain Scott and his comrades. I have pointed in the Prolegomenon that for many, a book about Captain Scott seemed a simple and easy way to become an author of significant historical English literature. For many, it also opened the way to the lecturing circus around the country, or on increasingly popular Antarctic cruises. For many, Captain Scott's story became an opportunistic vehicle through life.

If one compares the amount of historical documents related to many historical persons, one easily finds that Captain Scott's story is accompanied with a relatively small number of original documents. Thus, for many it seemed that to write about Captain Scott and his expeditions was a simple and straightforward task. Combined with readers' genuine interest in Captain Scott, and more generally in exploration and adventure, it represented an ideal opportunity for a number of individuals.

In Chapter 5, I pointed out some significant discrepancies between the actual and given temperatures by various authors. It was shown there that almost every author felt compelled to dramatize (decrease) the actual temperatures recorded by Captain Scott. In some instances, these changes were caricatural. In the case of Dr Solomon in Chapter 4, open data dragging, manipulation, and falsification were easily observed and proven.

It would be pointless to debug every work about Captain Scott. However, since in this chapter I am concerned with Captain Scott's performance as a leader and organizer of the *Terra Nova Expedition*, I feel compelled to point out to readers several grand errors by various authors related to the orders given to Meares.

⋮

Sir Ranulph Fiennes. Every author writing about Captain Scott eventually fell into Huntford's trap of verbal orders to be carried back to Meares. However, the strangest and most spectacular fall was produced by the anti-Huntford crusader Sir Ranulph Fiennes. Unfortunately, instead of clearing various issues distorted by Huntford, Sir Ranulph blindly and without research of the original sources repeated Huntford's fabricated story. In Chapter 5.2, I pointed out that in a number of situations Sir

Ranulph fabricated certain temperature data to exaggerate the severity of Captain Scott's temperature record – and his own. Additionally, if one embarks on debunking other works, the cross-examination of original documents is a must. Here is what Sir Ranulph has to say about Huntford's verbal orders[87]

> The Team chosen, Scott gave various messages to Teddy Evans to take back to Cape Evans. One, for Meares, updated his previous three instructions on what he wanted the dog teams to do. This last order cancelled the previous [*sic*] ones: Meares was to come out and meet Scott between 82° and 83° on the Barrier at some time towards the middle [*sic*] of February.

Sir Ranulph repeats Huntford's fabrication without bothering to give his own interpretation. In the previous section, I briefly discussed the vagueness of Huntford's sentence, and its meaning that Meares was to meet or depart to meet Captain Scott in the middle of February. The reader may one more time consult these comments. This time, Sir Ranulph concluded that according to the order Captain Scott gave to Lt Evans, "Meares was to come and meet Scott towards the middle of February". Obviously if this was the order, it was only achievable by Meares if the order was passed to him *via* satellite telephone! Alternatively, Sir Ranulph must tell the readers how Meares could follow Captain Scott's orders before the Second Return Party arrived at Hut Point. Provided that the actual sledging distance between Hut Point and 83°S *via* Corner Camp is about 328 miles, Meares would need about 3 weeks to dog-sledge there.

It appears that Huntford's original fabrication of Captain Scott's verbal order carried back to Hut Point by Lt Evans has started its own life. Many authors, if not all of them, repeated Huntford's fabrication, just rewording the original entry. Sometimes re-writing leads to even more hilarious statements, like Michael Smith in his Captain Oates biography[88]

> Evans also carried another message for either Meares or Atkinson to bring the dogs out to 82° or 83° in mid-February to help the returning party catch the *Terra Nova* before she escaped the clutches of the ice. Scott happily assumed that Evans, Crean and Lashly would have an easy 750-mile ride home. It was a dangerous assumption.

Michael Smith, like Sir Ranulph, believes that a satellite telephone was used. On top of that, Smith adds his own interpretation of what Captain Scott was assuming. Actually, what Captain Scott was assuming was his 144-days sledging journey, and that the average sledging velocity over a long period of time for each man-hauling party would be about 10.1 miles/day. In the previous chapter, I discussed in some detail how all sledging parties progressed relative to the 144-days plan. I do not confirm that Smith's happy/unhappy element was present in digits proposed and observed by Captain Scott. The sledging distance back to Hut Point was 613.5 miles, and not 750 miles as given by Smith. For debugging of only one page from the Smith book where he comments about Captain Scott's verbal orders, the reader may see this reference.[89]

⋮

Diana Preston. Oxford-educated historian and writer Diana Preston, "the author of the acclaimed *A First Rate Tragedy: Robert Falcon Scott and the Race to the South Pole*"[90] who

apparently consulted "the original sources held by the Institute [Scott Polar Research Institute]"[91] still found it far too tempting to not add to her cogitation[92]

> Evans was also carrying an oral message which would play its part [*sic*] in the disaster ahead. Scott had changed [*sic*] the instructions yet again for the dogs. Meares was to bring the teams out to meet the returning party between 82° and 83°S towards the middle of February, to enable the returning Polar party to be in time for the *Terra Nova*. It is questionable whether these were the most effective arrangements, but Scott's great mistake [*sic*] was to assume that Evans would deliver the message in time [*sic*]. Scott had predicted [*sic*] Evans would make a quick journey back but he could not have been wrong. He shared a mistaken belief [*sic*], common among the expedition members, that the homeward journey must be easier [*sic*] than the outward one.

What Preston presents here is an even bigger and utterly nonsensical fabrication. She uses Huntford's fabrication to "play its part in the disaster ahead". Moreover, she finds that the Huntford fabrication was Captain Scott's "great mistake". Right after that, Preston attributes to Captain Scott contradictory arguments that he assumed, and then predicted, that Lt Evans would have "a quick journey" to Hut Point.

In order to summarize her cogitative analysis of the non-existing Captain Scott order carried by Lt Evans, Preston reproaches Captain Scott and fellow explorers with their "mistaken belief" that "the homeward journey must be easier". However, if such a notion was shared by them before embarking on the South Pole journey, they proved that indeed their homeward sledging velocity was about 30% higher than the inward velocity. This is clearly demonstrated on my Fig. 2.3, where the velocities of the Main, First and Second Returning parties are depicted.

⋮

David Crane. In the latest, and what could be judged by its size to be the most comprehensive Captain Scott biography, David Crane gives his own account of the events discussed in this chapter and subsection. It is interesting to notice that while David Crane spends about 496 pages (in the American edition by Alfred A. Knopf, 2006) on Captain Scott's life, he needs only about 25 pages to cover the most interesting and crucial days for Captain Scott, starting in January 1912.

Right from the beginning, Crane finds it compelling to inform the readers about the verbal orders fabricated by Huntford [93]

> When they were not talking about food, they were talking about the final element in the "Oriental trap" [*sic*] that Scott had set for himself, and that was the possibility of the dogs coming out to meet them. In the early stages of the journey south he had written Day a note for Simpson that left the whole question in suspension [*sic*], but on 4 January, when he had had time and opportunity [*sic*] to assess both the dogs' capabilities and his own likely needs, he had given Teddy Evans the last of a series of instructions taken back by the returning parties, ordering that the dogs should be brought out to meet him somewhere between 82 and 83°S.

The first surprise awaits the reader when he/she notices that according to David Crane, in Captain Scott's note to Dr Simpson that he should not "forget that the

[supplies] must be got to One Ton Camp, Lat 79½ somehow," somehow "left the whole question in suspension" and not in action. Right after that, Crane in a falsely managerial way adds, "but on 4 January, when he had had time and opportunity to assess both the dogs' capabilities and his own likely needs," it out of the blue occurred to Captain Scott to give new orders to be sent to Cape Evans. Indeed, Crane writes complete nonsense like in a typical character assassination scenario.

It is indeed phenomenal how David Crane, based on Huntford's fabrication of Captain Scott's verbal orders, is pushing his fabrication forward by making it even bigger and more persuasive[94]

> If all had gone as planned with the final returning party, the system [*sic*] might well have worked – logic and hierarchy made Evans the natural conduit for any orders – but it was a chain of command that had not taken into account [*sic*] the possibility of illness.

David Crane needs only 45 words, or 216 letters, to explain his false hypothesis. Indeed, towards the end of the return of the Second Return Party, Lt Evans was seriously affected by scurvy. However, since this illness was not a sudden event but rather a long deterioration of Lt Evans' health, he certainly was obliged to pass on Captain Scott's orders to his subordinates in the case of his death before reaching Hut Point. Even without his illness, I suppose that since verbal orders of Captain Scott were so vital to his return, Lt Evans would have had to inform his comrades about the orders just in case of his fatal fall into a crevasse, or otherwise sudden death. Since all of it was made up, one cannot find a word of reference about these verbal orders in Lt Evans' book[95], as well as in Lashly's diary.[96]

One would expect that David Crane's imaginary expounds above would not continue beyond what was cited above. However, they continue. Crane again and again distorts the story, and at its closure indulges the reader with a breakneck observation

> No man could have done more than Crean or Lashly, no party could have more selflessly short-changed themselves at the depots to ensure that Scott's man had enough, yet the bitter irony was that their triumph left Scott in a worse stew than ever [*sic*]. With Evans still gravely ill Atkinson was now automatically [*sic*] in command, but as the only doctor his clear duty – even if it meant ignoring Scott's instructions over the dogs – was to get Evans to base camp and back to New Zealand in *Terra Nova* as quickly as possible.

Crane's above comments are indeed loaded with twisted threads and hidden assumptions. One of the assumptions is that Huntford was telling the truth about Captain Scott's verbal orders. Of course, Huntford fabricated the story to discredit Captain Scott, and the actual written orders were issued back in October 1911. David Crane's suggestion that their (Lt Evans, Crean, and Lashly's) successful struggle to return to Hut Point "left Scott in a worse stew than ever" is indeed a suggestion that they virtually killed Captain Scott. It is sheer character assassination against the Second Return Party. Following Crane's "logic," one can assume that if the Second Return Party perished on the Barrier, then Captain Scott would be in a better situation. But then his verbal order would not have been not delivered to Cape Evans, and the dogs would not have been not brought to "82 and 83°S". One can see that according to David Crane's presentation, the return of the Second

Return Party was not in any way good for Captain Scott. In his own words, "it is a miserable jumble"[97].

The above discredits David Crane's book. From the perspective of the *Terra Nova Expedition*, his alleged verbal orders given to Lt Evans were of preliminary importance and a matter of life and death. Roland Huntford's fabrication, along with David Crane, Sir Ranulph, Preston, and others' blind repetition of this counterfactual is an unpleasant twisting of the actual history of the *Terra Nova Expedition*.

But the twisting does not end with Captain Scott and the Second Return Party. Captain Amundsen has also become the target of invented attacks. The first is from – surprise, surprise –

⋮

Sir Ranulph Fiennes. In his book *Captain Scott*, Sir Ranulph alleged[98]

> The greatest of French polar explorers, Dr Jean Charcot, wrote in *Le Matin*: "Scott has conquered the Pole. The public, ill-informed, will say he reached his goal only second; but those who know – Amundsen and Shackleton, I am sure among the first – will say that it was Scott who opened the road to the Pole and mapped out the route; and a halo of glory, shedding a reflecting glow upon his country, will surround his name." He added: [*sic*] "Scott would not turn aside from his scientific programme … It is quite another thing with Amundsen. He is not a scientist. He is rather bent on setting up a record. *If one wishes to pronounce the one greater than the other, the preference must go to him who surrounds this magnificent result with the greatest number of discoveries and scientific observations*." [emphasis mine]

Checking the endnotes[99] for Sir Ranulph's allegation shows just how sloppy Sir Ranulph's scholarship truly is. The first quote is from the *Daily Mail*, Feb. 12th, 1913, and the second quote is from the *Sheffield Independent*, Mar. 8th, 1912! According to Sir Ranulph, Dr Charcot spoke in his interview before he ever gave it! But what demonstrates that Sir Ranulph forged the second quote can be found simply by reading Dr Charcot's kindly statement on March 8th, 1912, whose ending Sir Ranulph plagiarized[100]

> Assuming as highly probable that both reached the south pole, the question of priority, which in my opinion can only be one of a few days, is of little importance. *If one wishes to pronounce the one greater than the other, the preference must go to him who surrounds this magnificent result with the greatest number of discoveries and scientific observations.* [emphasis mine]

It is beyond doubt that Sir Ranulph forged a quote and plagiarized from a contemporary explorer to attack his hated enemy Captain Amundsen; Sir Ranulph's words like "Amundsen proved to be a master of deceit"[101] sarcastically come to mind.

⋮

Tor Bomann-Larsen, Ross MacPhee, and Chris Turney. In 2010, Ross MacPhee published his book *Race to the End: Amundsen, Scott, and the Attainment of the South Pole*. His invented attack came while he was summarizing the ascent of the Axel Heiberg Glacier[102]

> Amundsen also understated his increasingly poor management of relations with some of the men. At one point, after an argument with Bjaaland, he ordered the man to return to Framheim with Hassel as his companion. This could have placed the whole expedition in serious jeopardy, but Amundsen would not brook being challenged or contradicted. In later years and on other expeditions, this imperious streak would come through more and more: Cross him in any way and you would become superfluous, to be disposed of like any form of offensive matter. This time Bjaaland apologized and the team moved on, but feelings were raw. "One might think the man has a screw loose," wrote Hassel. "He has many times in the last few days actually initiated quarrels, an extraordinary stand to take for a Governor and leader for whom peace and good camaraderie should be the main target."
>
> Having achieved the edge, if not the top of the actual plateau, Amundsen ordered the dogs that would not continue on to the pole to be shot and butchered to feed those that would …

This near breakup in Captain Amundsen's party alleged by MacPhee is sloppily cited and ultimately unsubstantiated. Only the Hassel quote has any source, to his diary as quoted in Tor Bomann-Larsen's biography of Roald Amundsen.[103] The diary entry is dated Dec. 12th, 1911, two days away from the South Pole and well after the summit of the Axel Heiberg Glacier was reached, directly contrary to MacPhee's context. Indeed, checking Bomann-Larsen's book reveals that this alleged dispute occurred part way up the Axel Heiberg Glacier, not at the top.[104]

Surprisingly for such a novel and serious charge, Bomann-Larsen does not give a full quote of Hassel. Instead, he gives a brief, non-specific quote and fills in the rest himself. Checking Bjaaland's published diary[105] reveals no indication of this near breakup, nor does it indicate Bomann-Larsen's claims of a general attitude of being "critical of many of his [Amundsen's] decisions" or a dislike of Captain Amundsen's personality.[106] How Bomann-Larsen felt the confidence to state these falsehoods becomes clear when one notices that not only does he fail to comment on the apparent absence of his above-mentioned allegations from the diaries of every other polar party member, his list of unpublished sources[107] does not include the diaries of Bjaaland, Hanssen, or Wisting. Bomann-Larsen's misconduct is eerily reminiscent of Stephen Ambrose's defamation of WWII veterans who he never interviewed.[108]

Chris Turney is in a shocking league of his own. He not only repeats Bomann-Larsen's falsehood,[109] he does not bother to cite Bomann-Larsen as a source for this in his detailed list of sources.[110]

⋮

Karen May and George Lewis. Not to be outdone, Karen May and George Lewis in 2015 launched their own invented attack against Captain Amundsen by accusing him of fatalism, if not being outright suicidal.[111] I will not go into their full list of misconduct from this paper, but will merely point out the three most egregious examples. The first example is how they twist the meaning of Captain Amundsen's statement "Make me a free man"[112]

> Make me a free man: such language, together with relinquishing his collection of medals and honors, suggests a somewhat fatalistic attitude.

It boggles the mind just how a fatalistic man could possibly feel dependent on anyone other than himself for his freedom. One is forced to recall Audie Murphy, who also relinquished his medals yet showed no fatalism; a thorough search could easily turn up more examples. The second example of their attacks abandons reality altogether[113]

> More importantly, Amundsen would have seen for himself that the Latham was a prototype, as the words 'Latham N°02', indicating the second prototype model, were clearly visible on its nose (Fig. 1). Hence he should have been aware that the craft was unlikely to have been fully tested.

Just how Captain Amundsen would have known French aviation nomenclature escapes me, as well as any reader who is paying attention. But the authors continue to use this special pleading throughout the remainder of their paper. I would not expect Karen May and George Lewis to suddenly know Polish aviation nomenclature when shown a prototype of one of our P.Z.L. (Państwowe Zakłady Lotnicze – State Aviation Works) helicopters, but they would expect Captain Amundsen to know just that.

The third example is intended by them to exaggerate Captain Amundsen's authority over the aircraft's operation[114]

> Huntford's statement has the effect of parcelling out responsibility to Amundsen, Dietrichson and Guilbaud: if all were aware of the Latham's unsuitability, then all bore blame for the disaster. In Guilbaud's case such an implication is unfair, since he had no freedom to refuse. As Guilbaud stated in an interview, they were on an official mission: 'Our mission is to take on board the Norwegian explorer Amundsen, who will guide us in our searches over the polar regions' [… nous avons pour mission de prendre à bord l'explorateur norvégien Amundsen, qui nous guidera dans nos recherches audessus des régions polaires] (Le Petit Parisien 16 June 1928: 1).
>
> Why was Cavelier de Cuverville's presence judged necessary on the final flight? Arguably he helped support Guilbaud on the Latham's flight from Caudebec to Bergen, but on 17 June an experienced polar flyer, Dietrichson, was present in Bergen to take over from him; Guilbaud, as the pilot familiar with the Latham's controls, would still have been responsible for the crucial tasks of taking off and landing.

May and Lewis would have us believe that a pilot who knew the aircraft could not refuse Captain Amundsen, who did not know the aircraft. This is based on their fixation on their interpretation of Guilbaud's ambiguous statement, which could also be interpreted to indicate that Amundsen would merely be choosing the search area. Regardless, Captain Guilbaud could have refused to fly when circumstances made it dangerous, using a fundamental principle that was codified many years later in U.S. law as 14 CFR 91.3(a): "The pilot in command of an aircraft is directly responsible for, and is the final authority as to, the operation of that aircraft."[115] Furthermore, they discount the reality that de Cuverville was experienced with the aircraft, while Dietrichson had no experience with it. Even today, one would not expect any pilot to take off in their aircraft and then hand the controls over to a pilot with no experience with that aircraft.

As a bonus, their most egregious mistake should have resulted in them being laughed out of *Polar Record*[116]

> The S.55 was better equipped for a water landing amidst broken pack ice, as she had strong, all-metal twin hulls [*sic*], high-mounted wings and no underwing stabilizer floats … As Ellsworth later explained, 'As we had no idea upon what we were going to land, only faith that we would land safely on something, our two all-metal Dornier-Wal planes were equipped for landing either in water or on ice' (Ellsworth 1928: 7) … The strong metal-hulled S.55 [*sic*] and Dornier-Wal were the models Nobile must have envisaged when he asked for a 'hydroplane with a considerable flying range'.

Did they honestly wonder about the construction of the Savoia-Marchetti S.55? If, instead of consulting reference works from 1969–1981, they had consulted a contemporary reference work like the 1929 edition of *Jane's All the World's Aircraft*, they would have found the following in the S.55's entry[117]

> HULLS. – Two short, single-step hulls mounted under the extremities of the central wing-section. The structure is of ash, spruce, and plywood, the whole being covered with plywood. Below the flotation line, the skin is doubled, with doped fabric between the two skins. Each hull is lighted and ventilated.

An interesting observation can be made if one visits the Altmetric web page for this paper, and looks at the Twitter messages quoting it. All three Twitter messages carry the following description, which apparently is the default description: "Academic analysis of deaths of Roald Amundsen and Latham 47 crew lays blame for the tragedy firmly at Amundsen's door".[118] Is this description the authors' creation, or the creation of the Scott Polar Research Institute, who published this paper in their peer-reviewed journal?

It is a miracle that the same people who mindlessly repeated Huntford's misconduct of inventing actions by an expedition leader have not yet found these other inventions. It is infuriating that this could happen again and add to recent high-profile examples of scholarly misconduct.[119]

10.6. The 11 Miles Myth

10.6.1. The Myth

In every story, and especially in mythological tales, the spatiotemporal distance between death and salvation is usually small. Its size inversely amplifies its importance. It is like in the physics of chaos, where infinite sensitivity on initial conditions makes the system evolve in a chaotic fashion. In Chapter 1, I briefly discussed the physical properties of such a system.

Ever since I started making various plots of sledged distances and respective sledging velocities (see Fig. 2.3), I noticed a number of discrepancies in marking various geographical locations. The most striking was that during the *South Pole Journey*, Captain Scott was not giving precise geographical locations of his party. While he was fairly frequently estimating the party latitude, his estimations of longitude were sporadic.

Toward the end of their journey in March 1912, their sledged distances become shorter and shorter. Finally, Captain Scott wrote in his journal[120]

> Wednesday, March 21. Got within 11 miles of depot Monday night …

and Cherry-Garrard noted afterwards[121]

> … eleven miles from One Ton and plenty!

The tent with Captain Scott, Dr Wilson and Lt Bowers remained at this location to the end. A long debate – in Cherry-Garrard "what if" style – has ensued about the chances of the Captain Scott party reaching One Ton Depôt. The discussion was indeed superficial and lacking attention to practical details like distances, locations, weather conditions, the physical state of the party, *etc*.

The first surprise awaits one who carefully reads the geographical location of the last Captain Scott camp. Indeed, by consulting Cherry-Garrard and Captain Evans' books, and Dr Atkinson's reports, one finds

> Copy of Note left at the Cairn over the Bodies
> November 12th, 1912.
> Lat. 79°50′S. [*sic*]
> This Cross and Cairn are erected over the bodies …

Remembering that One Ton Depôt was established at about 79°29′S, one immediately gets the distance to the last camp to be 21 miles, which is not 11 miles as given by Captain Scott in his journal! This is a significant discrepancy, and a more detailed re-analysis is welcome.

The only way to figure out the real geographical location of One Ton Depôt is to look at all location data given in the writings of Captain Scott and his fellow explorers. Tab. 10.7 gives the locations of One Ton Depôt which I was able to find in the respective references. From this table, one can see that some inconsistencies in the *exact* location of One Ton Depôt exist, with upper bound longitude accuracy of ±1′, the location was 79°29′S, 169°22′E (–79.483333, 169.36666). I was also able to confirm (to within 1-mile accuracy) the location of One Ton Depôt by adding daily sledging distances during the outward journey in November 1911 (see Fig. 10.6 and also Fig. 2.3). Thus, it is evident beyond doubt that the actual location of One Ton Depôt was (79°29′±1′)S, 169°22′E (–79.483333, 169.36666).

Now, I turn to investigate the location of the last camp.

In support of Captain Scott's last camp location to be at 22/21 miles from One Ton Depôt, we have:

1. A note left at the Cairn over the Bodies – note was read and signed by all members of the search party. The Note gives the precise location of Captain Scott last camp to be 79°50′S,
2. Dr Wilson's letter to Reginald Smith,
3. Dr Atkinson's statement that "I decided then to march twenty miles south with the whole of the Expedition and try to find the body of Captain Oates. For half that day we proceeded south … On one of the old pony walls … we found Oates' sleeping bag, which they had brought along with them after he had left." This statement is impossible, if the last camp was 26–11 = 15 miles

Table 10.7. Locations of One Ton Depôt as given by Captain Scott and different explorers. The original notation was preserved.

1. Captain Scott gives the following location of One Ton Depôt: 1.1. Feb. 17th, 1911 79°28½′ S.[1] (no longitude given), 1.2. Feb. 17th, 1911 – 79°29′[2] (no longitude given).
2. Dr Simpson gives the following locations of One Ton Depôt: 2.1. 79°29′, 169°22′[3], 2.2. 79°29′, (no longitude given)[4], 2.3. 79°29′, 169°22′[5], 2.4. 79°30′, (no longitude given)[6], 2.5. 79°37′, (no longitude given)[7], 2.6. 79°30′, (no longitude given)[8], 2.7. 79°30′, 169°22′[9], 2.8. 79°30′ (no longitude given)[10], 2.9. 79½° (no longitude given)[11], 2.10. 79½°S (no longitude given)[12].
3. Silas gives the following locations of One Ton Depôt: 3.1. 79°28.5″S[13], 3.2. 79°29′S[14].
4. Cherry-Garrard* gives the following locations of One Ton Depôt: 4.1. Cherry-Garrard at five[15] occasions gives *his* estimation that One Ton Depôt was 130 miles (geographical) from Hut Point (*via* Corner Camp)[16] (see also subsection 10.6.2), 4.2. To our amazement we found their snowed-up tent some 140 geographical miles from Hut Point, only 11 geographical miles from One Ton Camp,[17] 4.3. 79°29′S.[18], 4.4. 79°29′[19].

* Cherry-Garrard could not learn many things, besides how to read a compass. However, at every occasion he was eager to add extra miles, and/or lower temperatures. The actual distance between Hut Point and One Ton Depôt (*via* Corner Camp) is 118 geographical miles. See Figs. 10.6 and 2.3. For Cherry-Garrard's *Glossary*, look at the end of the second volume of his book.[20]

1 Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R.F. Scott, R.N., C.V.O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 120.

2 *Loc. cit.*

3 George C. Simpson, *Meteorology*, Vol. III, *Tables*, Harrison and Sons, Ltd., London, 1923, *cf.* p. 596.

4 *Ibid.*, *cf.* p. 620.

5 *Ibid.*, *cf.* p. 649. (Motor Party)

6 *Ibid.*, *cf.* p. 653. (Dog Sledge Party inward journey)

7 *Ibid.*, *cf.* p. 659. (Dog Sledge Party outward journey)

8 *Ibid.*, *cf.* p. 673. (Day's Depôt Party)

9 George C. Simpson, *British Antarctic Expedition, 1910–1913, Meteorology*, Vol. I, *Discussion*, Thacker, Spink and Co., Calcutta, 1919, *cf.* p. 7.

10 *Ibid.*, *cf.* p. 8.

11 *Ibid.*, *cf.* p. 29 and 86.

12 *Ibid.*, *cf.* p. 39.

13 Collin Bull and Pat F. Wright (Eds.), *Silas: The Antarctic Diaries and Memoir of Charles S. Wright*, Ohio State University Press, 1992, *cf.* p. 70.

14 *Ibid.*, *cf.* p. 98.

15 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. II, *cf.* p. 326, 383, 503, 528, and Vol. I, *cf.* p. 116.

16 This Cherry-Garrard figure is incorrect. The actual distance is 118 geographical miles.

17 *Ibid.*, Vol. I, *cf.* p. lii.

18 *Ibid.*, Vol. I, *cf.* p. 116.

19 *Ibid.*, *cf.* p. 496.

20 *Ibid.*, Vol. II, *cf.* p. 580.

difference, as the # 14 camp was 26 miles from One Ton, but it is consistent with a 26 – 21 = 5 miles difference.

At the opposite end, to account for the 11 miles distance from One Ton Depôt we have the following:

1. Captain Scott's journal entry on Mar. 21st,
2. Dr Atkinson's, Cherry-Garrard's, and Silas' entries in their accounts.

In the middle, we have doubtful and uncertain observations:

1. In general, most of Captain Scott's party locations and travelled distances in March 1912 are uncertain,
2. On Mar. 17th, Captain Scott informs that the Party is at Camp No. 14. The distance between Camp No. 14 and One Ton Depôt is 144 – 118 = 26 miles. At the same instance, Cherry, Silas, and Atkinson say that they went 20 miles south from Captain Scott's last camp to search for Captain Oates' body. This gives the last camp location as only 6 miles from One Ton Depôt,
3. Cherry-Garrard's (see Tab. 10.4) original estimation of the distance from Hut Point to One Ton Depôt is 12 miles longer than the actual distance. By taking this correction, one gets the location of the Last Camp to be 23 miles from One Ton Depôt.

The summary of One Ton Depôt locations given by different explorers is given in Tab. 10.7, and supported by Fig. 10.6.

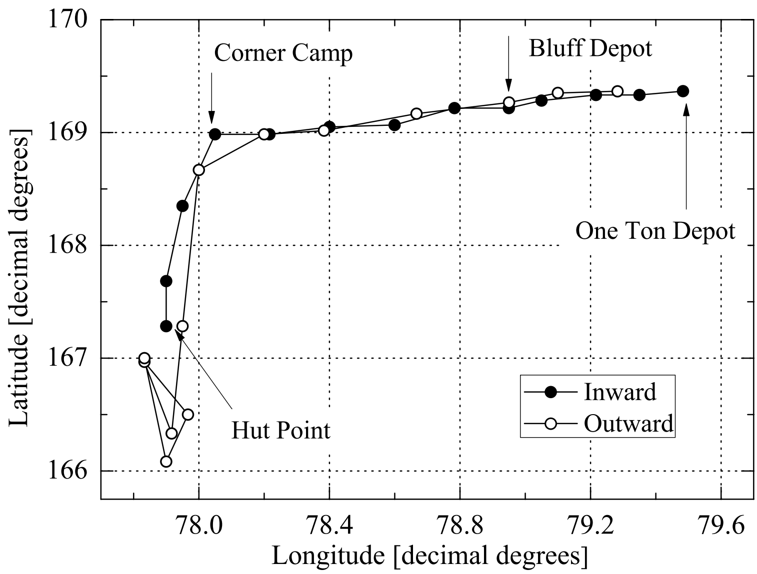


Figure 10.6. The plot of latitude and longitude of Register of [Captain Scott's] Party to One Ton Camp (Depôt), Jan. 26th through Mar. 23rd. Hut Point to One Ton Camp (Depôt) and Back.[1]

[1] George C. Simpson, *Meteorology*, Vol. III, *Tables*, Harrison and Sons, Ltd., London, 1923, *cf.* p. 593.

Let me briefly discuss some pertinent issues related to the above-mentioned accounts of Captain Scott's last camp.

A note left at the Cairn. The information provided in a *Note left at the Cairn* by the search party in November 1912 remains the most conspicuous, hard, and direct historical evidence that indeed the last camp of Captain Scott party was located about *21 miles* from One Ton Depôt. Additionally, there are at least three instances where Captain Scott's fellow explorers (Dr Atkinson, Cherry-Garrard and Silas) gave the location of the last camp at Lat. 79°50′S; it is *21 geographical miles* from One Ton Depôt.

Dr Wilson's letter. In one of his the last letters to Reginald Smith, Dr Wilson added a peculiar comment[122]

> We shall make a forlorn effort to reach the next depot but it means 22 miles and we are none of us fit to face it.

The letter was not dated, and the question arises when it was written. However, since in it Dr Wilson makes a reference to the four – soon to be nine days – blizzard, one must conclude that his letter to Smith was written on or after Mar. 24th, that is after the party pitched the tent in the last camp. Furthermore, Dr Wilson did not use the context of a round trip.

Thus, Dr Wilson confirms that the last camp was 22 miles from One Ton Depôt.

Captain Scott's Journal. On Wednesday (actually it was Thursday)[123] Mar. 21st Captain Scott wrote, "Got within 11 miles of depôt Monday night".

There are good reasons to doubt Captain Scott's entry stating a distance of 11 miles. Two reasons are mentioned above: the note left at the Cairn, and Dr Wilson's letter. The next doubt can be found in Captain Scott's journal. On Mar. 18th, Captain Scott informs us that his "right foot has gone, nearly all the toes". The next day Captain Scott casually comments, "we started in the usual dragging manner," and they sledged for about 5½ miles. It is quite a good distance, provided that Captain Scott could drag a sledge in the usual manner. However, it is difficult to imagine that with a frost-bitten foot Captain Scott could drag a sledge. Moreover, we already know that Captain Scott fabricated his temperature data and wind data, as well as apparent fuel shortage. The above casts doubt on the accuracy of Captain Scott's information that the last camp was at 11 miles from One Ton Depôt.

Fellow explorers' diaries. We have three accounts of finding the Captain Scott party in November 1912. However, only Charles Wright's account was written during the actual search. The remaining two accounts, Atkinson and Cherry-Garrard, were *post factum* re-collections. One should notice that these accounts give self-contradictory numbers, and therefore they cast doubt on themselves.

Doubtful and uncertain observations. These cases are listed above and the reader may re-read them.

Summa summarum, it is doubtful that the Captain Scott party's last camp was 11 miles from One Ton Depôt. It is more likely that the tent was at about 22 miles from One Ton Depôt.

10.6.2. Tacit Cover-up: How 22 Became 11

I have to admit that after learning about Tryggve Gran's following account (see Note Added in Proof), in my mind the 11 miles question stopped being a closed case, and was reopened. I was particularly intrigued about his justification for not giving the latitude of Captain Scott and his comrades' tent

> We have never given to anybody [*sic*] the right latitude and longitude, because we were afraid that people would go down and try to find them [*sic*]. As far as I know, I am the only one who's got the figures, because I took observations and wrote them down.

However, Gran's account at first appears to be pure nonsense. After all, the note left at the cairn-grave, and signed by everyone from the Search Party gave its precise location at Lat. 79°50′S, as anyone could learn from the second volume of the *Terra Nova Expedition*, published in 1913. The text of the note was known from 1913, when the second volume of the *Terra Nova Expedition* was published. What would be wrong or unethical with travelling to Antarctica and searching for the grave and paying tribute to Captain Scott and his companions? After all, most visitors at Grytviken, South Georgia assemble at a little hill to pay their respects to Sir Ernest Shackleton at his grave. Commander Evans had declared on the expedition's return "The snow cairn erected over them will probably be discoverable for many years."[124] And afterwards, a Canadian named Alexander Scott had offered to retrieve the bodies if the Royal Geographical Society approved.[125]

While wondering about Gran's allegedly classified observation of the last camp, I once more looked at the distances travelled by various parties on the Barrier. I was intrigued by the following non-assuming entry in Captain Scott's journal

> *Wednesday, November* 15.—Camp 12. Found our One Ton Camp without any difficulty [130 geographical miles from Cape Evans]. About 7 or 8 miles. After 5½ miles to lunch camp,

Many times had I read the journal of Captain Scott, and I had not noticed how incomprehensible this comment was. It is right, and yet it is wrong. Is it possible that Captain Scott could make such a gross mistake as to shift his mentally accepted starting point from Hut Point to Cape Evans? No. We know from the previous chapters that Captain Scott fabricated meteorological data. However, this occurred only after his party reached the South Pole and started to descend the Beardmore Glacier.

In November 1911, hopes were high. If it wasn't Captain Scott's fabrication, then whose was it? The next obvious culprits were the lauded editors, Leonard Huxley and Cherry-Garrard, who as I showed in section 2.2 tampered with Captain Scott's journal before its first edition in 1913 and changed a number of temperature data to lower the recorded temperatures. This brings us back to Dr Max Jones' 2006 version of Captain Scott's journals[126] by Oxford University Press. His version was acclaimed (though not by its publisher, Oxford University Press) as an *unexpurgated* edition, accompanied with the groundbreaking *Editor's Appendix III – Significant Changes To Scott's Original Base and Sledging Journals (18 October 1911–29 March*

1912). Dr Max Jones, a Senior Lecturer in Modern History at the University of Manchester, declared[127]

> Alterations which did not significantly change [*sic*] the meaning of the published text have not been included in this appendix [*sic*]. The editors tidied up Scott's prose, correcting grammar, spelling, and punctuation quite heavily on occasion, but not consistently.

Looking at Dr Jones' Appendix III, on page 468 one finds only the corrected temperature entries for Nov. 13th and 25th, 1911. No correction for Nov. 15th! Since Dr Jones, as a trained historian published[128]

> the first list of all the significant changes made to Scott's original in *Scott's Last Expedition Vol. I Being the Journals of Captain R. F. Scott, R.N., C.V.O.* (London: Smith, Elder, 1913).

and there was no correction to the above Captain Scott entry on Nov. 15th, meaning that Captain Scott was indeed committing an impossible deviation from his starting point by correctly writing that One Ton Camp (Depôt) was "[130 geographical miles from Cape Evans] [*sic*]". However, the actual distance between Captain Scott's accepted starting point at Hut Point (*via* Corner Camp) and One Ton Depôt was about *118 geographical miles*. I could not believe that Captain Scott in November 1911, without any apparent reason, was interested in shifting his starting point from the previously accepted and used Hut Point to Cape Evans.

Parts of Captain Scott's journals are available at the British Library's website to read. Anyone using the internet can readily access it and try to decipher his awful handwriting. Page 9 of the journal starts from the top with the Nov. 15th entry,[129] and the line alleged to Captain Scott "[130 geographical miles from Cape Evans]" is not there! The investigative reader is asked to complete a small investigation by looking at the original journal at the website of British Library, and then the printed journal.

It is obvious that the location of One Ton Depôt at about "[130 geographical miles from Cape Evans]" was not written by Captain Scott, and that since it appeared in the first and all remaining editions, it was added to the journal by Huxley and Cherry-Garrard and persisted there for more than 100 years, including Dr Jones' edition.

Long before this finding, I developed a distrust of Cherry-Garrard's writings, and more importantly actions taken by him, especially before and during his journey with the First Relief Party. But now, after finding the "[130 geographical miles from Cape Evans]" addition to Captain Scott's journal, I have lost complete trust in Cherry-Garrard's integrity. It is evident that Huxley and Cherry-Garrard directly, ruthlessly, and cynically tampered with Captain Scott's journal.

As we have already seen in section 2.2, Dr Jones' self-assumed quest for an *unexpurgated* transcription of Captain Scott's journal seriously played down the aim and extent of altering the temperature record[130]

> Over 175 of the temperatures which Scott recorded during the polar journey were published in *Scott's Last Expedition*. Thirteen of these were reduced, exaggerating the severity of the conditions faced. Yet the rationale behind the changes is confusing. The editors limited themselves [*sic*] to switching '+' to '–', hesitating [*sic*] perhaps to tamper [*sic*] with a sacred [*sic*] text.

Indeed, limiting oneself to the "small" change of temperature sign from '+' to '–' was insignificant, and without a "rationale behind" it. In section 2.2, I discussed these changes in a more detailed way and showed that these changes were not transcription errors, but deliberate changes to exaggerate the severity of the temperature conditions.

Two questions remain pending:

1. Why was it added to Captain Scott's journal?,
2. Why it was not detected, even if Dr Max Jones presumably compared word after word of the original Captain Scott journal with its printed version?

Originally, a scan of Captain Scott's journal was to appear here as a vivid documentation of Huxley's and Cherry-Garrard's manipulation. Unfortunately for the readers of this book, the permission to reproduce a small part of Captain Scott's journal for a purpose that could not harm Captain Scott was not granted by the apparent copyright holder, his grandson Mr Falcon Scott. Here is how the question of getting permission was addressed.

[Sep. 2nd, 2014]
Hello, I wish to use in my upcoming book publication a copy of Captain Scott's journal entry from Nov. 15th, 1912. How should I proceed to get permission. Best regards, Dr Sienicki.

[Sep. 3rd, 2014] Hi Kris,
Please let me know a little more about your book publication, the extract you want to use, and the context [*sic*] in which you intend to use the Diary extract.
We are usually very supportive to people wishing to refer to my grandfather's legacy.
Kind regards, Falcon Scott

[Sep. 3rd, 2014] Dear Mr Scott, please find attached file. I intend to use this part of Captain Scott's journal to show that certain changes were made in printed version of Journals. In this particular case "[130 geographical miles from Cape Evans]" was added. Best regards, Dr Sienicki

After two responses, no further response was received from Mr Falcon Scott. Apparently, my neutral context was not appropriate "to refer to [Mr Falcon Scott's – KS] grandfather's legacy".

Figure 10.7. What could have been the scan of an original page of Captain Scott's journal for Nov. 15th, 1911.[1] Deciphered from Captain Scott's journal: "(Left upper corner) Nov.15th Camp 12 Wednesday. (Main Captain Scott entry text) Found our One Ton Camp without any difficulty. About 7 or 8 miles. ["7 or 8" is written over "6 or 7"] After 5½ miles to lunch camp, Chinaman was pretty tired, but went 24 [the meaning of 24 is unclear, 24h?] on again in good form after the rest. All the other ponies made nothing of the march, which, however, was over a distinctly better surface." Needless to say, Huxley and Cherry-Garrard's "[130 geographical miles from Cape Evans]" is *not* present.

[1] http://www.bl.uk/turning-the-pages/?id=12878b6a-36b9-44db-a940-365b21bfe524&type=book (accessed August 27th, 2014).

To answer the first question, one has to return to the beginning of the current chapter, where I discussed various elements of the insidious and tacit mutiny which took place at Cape Evans in late 1911 and early 1912, as described in sections 10.1 to 10.4.

There are two sources which give essential data to calculate the distance sledged between Hut Point and One Ton Depôt *via* Corner Camp. They are geographical coordinates of these locations, and more importantly coordinates of camps made during two sledging journeys: the One Ton Depôt Party/Day's Party, Jan. 26th through Mar. 23rd, 1911, and the Main Polar Party in November 1911. Field records of the One Ton Depôt Party are especially trustful, as precise locations (longitude, latitude and magnetic variation (declination)) of each camp were measured to ensure the accuracy of data for the upcoming journey to the South Pole. A summary of this record was compiled by Captain Scott and is depicted on Fig. 10.7. The investigative reader may rightly recall at this moment Captain Scott's instructions to memorize magnetic declinations between successive camps.

A summary distance sledged by the One Ton Depôt Party/Day's Party as depicted on Fig. 10.8 and Fig. 10.9 gives 111 miles from Safety Camp and 119.55 miles from Hut Point, respectively, since the distance between Hut Point and Safety Camp is about 8.92 miles, which gives 119.92 (111 + 8.92) miles. Thus, I conclude that

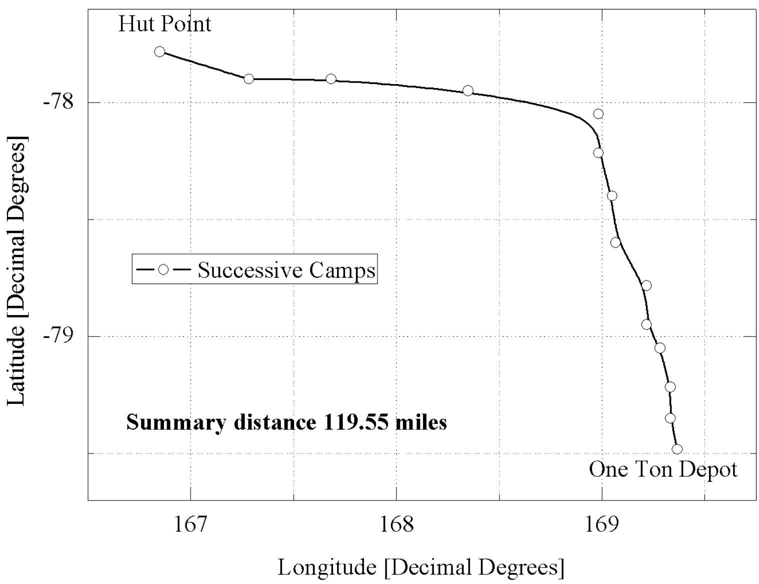


Figure 10.8. One Ton Depôt journey, Jan. 26th until Feb. 8th, 1911[1] from Hut Point (–77.78333, 166.85) *via* Corner Camp (–77.9, 166.28333) to One Ton Depôt (–79.475, 170). The summary sledged distance was 119.55 geographical miles. The solid line is a B-spline through successive camps denoted by ○. The investigative reader may observe that the distance, calculated as a straight line between Hut Point and Corner Camp was 10.06 geographical miles, and from there to One Ton Depôt was 104.59 geographical miles (10.06 + 104.59 = 114.65), which differs from the sledged distance 119.55 miles by 4.9 miles.

[1] George C. Simpson, *Meteorology*, Vol. III, *Tables*, Harrison and Sons, Ltd., London, 1923, *cf.* p. 592.

Summary of Marches made on the Depôt Journey

Distances in Geographical Miles. Variation 152 E.

			m.	yds.	
Safety	No. 3 to 4	E.	4	2000	
		S. 64 E.	4	500	
	4 to 5	S. 77 E.	1	312	9·359
		S. 60 E.	3	1575	
	5 to 6	S. 48 E.	10	270	Var. 149½ E.
Corner	6 to 7	S.	10	145	
	7 to 8	S.	? 11	198	
	8 to 9	S.	12	325	
	9 to 10	S.	11	118	
Bluff Camp	10 to 11	S.	10	226	Var. 152½ E.
	11 to 12	S.	9	150	
	12 to 13	S.	7	650	
	13 to 14	S.	7	Bowers 775	
	14 to 15	S.	8	1450	
			111	610	

Figure 10.9. Taken from Captain Scott's journal[1], a summary of marches made to One Ton Depôt journey Jan. 26th through Feb. 8th, 1911. The meaning of 64E., 77E., 60E., 48E. is unknown.

[1] Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R.F. Scott, R.N., C.V.O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 128.

the distance sledged between Hut Point and One Ton Depôt by the One Ton Depôt Party/Day's Party was somewhere between 119.55 to 119.92 geographical miles.

Using data collected by the Captain Scott party during Nov. 3rd through Nov. 15th, 1911, one gets $118 = \{11 + 10 + 10 + 10 + 0 + 11 + 10 + 9 + 9 + 10 + 10 + 11 + 7\}$ miles sledged between Hut Point and One Ton Depôt. Thus, it is beyond question that the sledging distance between Hut Point and One Ton Depôt was somewhere between 118 to 119.92 geographical miles. These figures are absolutely certain. All through this book, I have used the 118 miles figure, as it comes *directly* from Captain Scott's data during the South Pole journey.

Why then did Huxley and Cherry-Garrard tamper with Captain Scott's record (journal) to obfuscate readers by adding to the original text that One Ton Depôt was "[130 geographical miles from Cape Evans]"? Although Cape Evans was the principal location of expedition headquarters, at all times during the planning and execution of Captain Scott's sledging to the South Pole, Hut Point was used as the starting and finishing location. *All* distances, food/fuel rations, times of departure, and the return of all parties were given in terms of Hut Point's location. During the sledging journeys, Hut Point was the base camp of the expedition in the whole sense of this term. The salvation awaited anyone who reached it, like Crean who walked for 18 hours to fetch help from Hut Point, where the *Discovery Expedition* (1901–1904) hut was standing.

Although Huxley and Cherry-Garrard's line "[130 geographical miles from Cape Evans]" is formally correct, I think that they had made a mistake, and intended to insert into Captain Scott's journal that One Ton Depôt was "[130 geographical miles

from *Hut Point*]". I base this observation on the above expounds of Hut Point's location as a reference location. Additionally, the location of One Ton Depôt at 130 miles from Hut Point is consistent with the respective distances enumerated by Cherry-Garrard and others. While sledging with Captain Scott, Cherry-Garrard noted[131]

> On November 15 we reached One Ton Depôt, having travelled a hundred and thirty miles from Hut Point [*sic*].

But they were not the only ones who cheated the readers. Actually, *everyone* who was giving the distance between Hut Point *and* One Ton Depôt *via* Corner Camp gave an incorrect figure, including:

- Huxley and Cherry-Garrard: 130 miles in Captain Scott's journal entry of Nov. 15th, 1911,
- Cherry-Garrard:[132] at numerous occasions including – 129 miles (Vol. I, *cf.* p. lii), 130 miles (Vol. I., *cf.* p. 180), 140 miles (Vol. I, *cf.* p. 186),[133] 130 miles (Vol. II, *cf.* p. 326), 130 (Vol. II, *cf.* p. 383), 122 [*sic*] miles (Vol. II, *cf.* p. 416), 130 miles (Vol. II, *cf.* p. 417), 130 miles (Vol. II, *cf.* p. 528),
- Charles Wright:[134] 150 miles (*cf.* p. 235),
- Captain Evans:[135] 150 miles (*cf.* p. 76),
- Ponting:[136] 150 miles (*cf.* p. 111) and 140 miles (*cf.* p. 290),
- Diana Preston:[137] 130 miles (*cf.* p. 142),
- Sir Ranulph:[138] 140 miles (*cf.* p. 206),
- Dr Solomon:[139] 130 miles (*cf.* p. 89),
- Drs Solomon and Stearns:[140] "79.6°S, 170°E"[141] and 136.6 miles[142] (*cf.* p. 13012),
- Dr Jones: 130 miles,[143] (*cf.* p. 323), 155 miles[144] (*cf.* p. 96)

An interesting feature of the above figures is that almost all of them add a minimum of 12 miles to the actual distance between Hut Point and One Ton Depôt. Up until this point, the main conspirator and culprit Cherry-Garrard had made only one mistake in his account, while describing the general situation before his departure with the First Relief Party.[145]

> Meanwhile the full rations for their return [Captain Scott party – KS] over the 140 miles (statute) from One Ton to Hut Point were still at Hut Point.

In Cherry-Garrard's book, for all the time he was giving the distance between Hut Point and One Ton Depôt in geographical miles (Captain Scott's sledgemeters were set to record geographical miles), but this time he used statute miles, which are about 0.8690 of a geographical mile, yielding about 122 miles distance, close to the true distance of 118 miles. Cherry-Garrard was close to the truth only on this occasion.

While looking at the false distances enumerated above, one has to keep in mind the time at which these distances appeared in print. Obviously Huxley and Cherry-Garrard's fabrications in 1913 were not the first to tamper with location and relative distances between One Ton Depôt, Hut Point, and Captain Scott's last camp. Actually the *true location* of Captain Scott last camp was given in:

- Note left at the Cairn over the Bodies – the note was read and signed by *all* members of search expedition. The note gives the precise location of

Captain Scott's last camp to be 79°50′S, *i.e.* 21½ miles from One Ton Depôt, 79°28½′S,
- Dr Wilson's letter to Reginald Smith refers to 22 miles.

One could rightly ask why I am trusting the above estimations of Captain Scott's last camp location while rejecting his own 11 miles estimation. In subsection 10.6.1, I presented a number of arguments. Here, two further arguments are added. The first argument is that the 11 miles figure given by Captain Scott is nothing more than the actual 22 miles figure divided by 2, a positive integer. Use of a positive integer (1, 2, 3, …) carries a precision that clearly indicates human activity. The second argument results from the fact that Huxley and Cherry-Garrard felt obliged to tamper with Captain Scott's journal by putting the actual One Ton Depôt about 12 miles southward. By their bungled southward shifting of the actual location of One Ton Depôt, "the editors" achieved an accord with the drama of Captain Scott's last days as described in his journal, and the celebrated text in *The Message to the Public* by perishing 11 trifling miles from salvation.

From distances sledged by the Captain Scott party as depicted on Figs. 10.7 and 10.8, it appears that his party's camp's location on Mar. 12th at 80°17′S is a certain figure. Building on that and on respective entries in Captain Scott's journal, one can consider the following scenarios:

11 Miles Scenario (the last camp was at 79°(28½ + 11)′S = 79°39½′S
If the last Captain Scott camp was at 79°39½′S, and if Captain Oates perished 18 miles[146] from it, it gives 79°57½′S as the location of Captain Oates' death, and the camp location at the time when Oates went outside (Mar. 16th). Consequently, it means that the party sledged about 20 miles (6.7 miles a day!) between the morning of Mar. 13th until the evening of Mar. 15th (80°17′ – 79°59½′). A dubious account[147] in Captain Scott's journal suggests that "I doubt if we can possibly do it"[148] – seven consecutive days marches of 6 miles to reach One Ton Depôt.

22 Miles Scenario (the last camp was at 79°50′S)
If the last Captain Scott camp was at 79°50′S, and if Captain Oates perished 20 miles from it, it gives 80°10′S as the location of Captain Oates' death. The actual party location at the end of Mar. 12th was 80°17′S. The difference of 7′ is equal to 7 miles. Therefore, the party sledged about 7 miles (2.3 miles a day) between the morning of Mar. 13th until the evening of Mar. 15th (80°17′ – 80°10′)S. This scenario would certainly be feasible for the party at this stage.

Additional – 22 Miles Scenario
On Mar. 16th/17th, Captain Scott comments, "We are at No. 14 pony camp". Camp No 14 was also reached by the party before, on Nov. 18th, 1911. This gives its confirmed location at 79°55′S and the distance to One Ton Depôt 26½ miles. That means that after Oates' death, the Captain Scott party was 26½ miles from One Ton Depôt.

In summary, out of these scattered figures a quite coherent picture is emerging. The Search Party consisted of two sub-units: a Mule Party (MP) and a Dog Party (DP): Atkinson (DP), Crean (MP), Dmitrii (DP), Gran (MP), Cherry-Garrard (DP),

Hooper (MP), Keohane (MP), Lashly (MP), Nelson (MP), Williamson (MP), Wright (MP). Right after finding Captain Scott's last camp on Nov. 12th, 1912, Dr Atkinson took control of the finding. However, evidently well before departure, the whole expedition was in disarray: in Wright's own words from a few months before this time period, "the scientific work has had to go to blazes."[149] At Cape Evans from September 1912 onward, no meteorological data was recorded. A similar meteorological record was also not recorded by the Search Party. Wright and Gran both gave different claims as to who was the first to spot Captain Scott and his comrade's tent. It is also not clear what was read by Dr Atkinson from Captain Scott's diary to the members of the Search Party

> [Atkinson][150] From Captain Scott's diary I found his reasons for this disaster. When the men had been assembled I read to them these reasons, the place of death of Petty Officer Evans, and the story of Captain Oates' heroic end.
> [Cherry-Garrard][151] Hour after hour, so it seemed to me, Atkinson sat in our tent and read. The finder was to read the diary and then it was to be brought home – these were Scott's instructions written on the cover. But Atkinson said he was only going to read sufficient to know what had happened – and after that they were brought home unopened and unread. When he had the outline we all gathered together and he read to us the Message to the Public, and the account of Oates' death, which Scott had expressly wished to be known.

Since the Search Party followed a well-established route, no measurements of latitude and longitude were taken or required. Certain duties were performed by Dr Atkinson, a cairn was built, and a *Note* was prepared and left "in [a] metal cylinder" at the cairn. This note was signed by all members of the party, 11 men (or 10 if not counting Dmitrii).

While writing *Chapter V: The Finding of the Polar Party* to appear in Vol. II., titled *Being the Reports of the Journeys & the Scientific Work Undertaken by Dr. E. A. Wilson and the Surviving Members of the Expedition*, Dr Atkinson precisely cited the text of the *Note*. It is fair to assume that while writing, he was in possession of a copy of the *Note*, and it is equally fair to think that this copy of the *Note* must be somewhere in the archives. The Note *explicitly* informs us that the Cairn was located at 79°50′S on Nov. 12th, 1912. This measurement was apparently taken by Tryggve Gran (see beginning of current subsection, and the *Note Added in Proof* at the end of this chapter) who years later, evidently forgetting about Dr Atkinson and Cherry-Garrard's printed account, suggested that the location of the Captain Scott party's last camp was classified.

Both volumes accounting for Captain Scott's *Terra Nova Expedition* were simultaneously published in 1913 in London by the Smith and Elder publishing house. It is evident that 79°28½′S (One Ton Depôt) – 79°50′S (Cairn) = 21½′. Thus Captain Scott's Cairn (last camp) was 21½ miles from One Ton Depôt, and *not 11 miles* as given in Captain Scott's tearful *Message to the Public*

> … and finally, but for the storm which has fallen on us within 11 miles of the depot at which we hoped to secure our final supplies. Surely misfortune could scarcely have exceeded this last blow. We arrived within

> 11 miles of our old One Ton Camp with fuel for one last meal and food for two days. For four days we have been unable to leave the tent the gale howling about us.

With one stroke of the pen, Huxley and Cherry-Garrard bungled, yet successfully shifted One Ton Depôt from 118 to 130 miles from Hut Point. An extra 12 miles, which is equal to 12′ and provides a false location of One Ton Depôt at a position of 79°40½′S. Now with Huxley and Cherry-Garrard's false addition, the math was acceptable to the readers. Since the "new" One Ton Depôt was at 79°40½′S and the Cairn was at 79°50′S it meant 10½′ difference, equal to 10½ miles! Much closer to Captain Scott's 11 miles. If we consider this falsification, and then consider that Gran could have been referring to this falsification by expedition members and Huxley when he suggested that the true location of the last camp was classified, *then Gran's seemingly nonsensical statement suddenly makes sense.*

There is one additional suspicious alteration of the published Captain Scott journal. On Mar. 7th 1912, Captain Scott wrote in his journal

> We only made 6½ miles yesterday. (R. 49.) This morning in 4½ hours we did just over 4 miles. We are 16 from our depot. If we only find the correct proportion of food there and this surface continues, we may get to the next depot [Mt. Hooper, 72 miles farther – KS] but not to One Ton Camp. We hope against hope that the dogs have been to Mt. Hooper; then we might pull through. If there is a shortage of oil again we can have little hope.

Someone, most probably Cherry-Garrard, added the line "[Mt. Hooper, 72 miles farther]" to the original text. However, this addition is incorrect and misleads the readers. First, it must be pointed out that the locations of Mount Hooper and Upper Barrier Depôt are the same {80°32′S, ~170°E} (see section 14.1 Appendix 1-Geographical Locations), and have been used interchangeably in different accounts, but always denoting the same food and fuel depôt. The location 80°32′S was reached by the Captain Scott party on Mar. 9th. The next depôt from Mount Hooper (Upper Barrier Depôt) was One Ton Depôt (Camp), at a distance of ~63.6 geographical miles (73.2 statute miles), which is just under a duration of 7 sledging days at a velocity of 10.1 miles per day. The culprit of this correction used "72" figure of *statute* miles to describe the distance, which is obscure and inconsistent since Captain Scott was *consistently* using geographical miles as a measure of the distance. When he used statute miles, Captain Scott always noted them as such.

However, the real point of moving the Mount Hooper (Upper Barrier) Depôt to 72 *statute miles* north was to take away the possibility of blaming of Cherry-Garrard, who was sitting idle at One Ton Depôt, by extending the distance between him and the next depot. Captain Scott's line "We hope against hope that the dogs have been to Mt. Hooper" is simple and unquestionable. Just three days later on Mar. 10th, Captain Scott observed

> Yesterday we marched up the depôt, Mt. Hooper. Cold comfort. Shortage on our allowance all round. I don't know that anyone is to blame – *but generosity and thoughtfulness have not been abundant* – The dogs which would have been our salvation have evidently failed. Meares had a bad trip home I suppose – *it's a miserable jumble*.

While looking at the above Captain Scott entry, Cherry-Garrard did not feel the need to add any additional misleading comments. After all, Meares was to blame, regardless of the nature of his return trip. But Cherry-Garrard felt obliged to remove from Captain Scott's published journal the two entries as shown in the above citation in italics.

Needless to say, Dr Max Jones[152] – unlike Roland Huntford[153] – did not notice the addition of the above-cited line "[Mt. Hooper, 72 miles farther]" in his "unexpurgated" edition of Captain Scott's journals. Neither did he notice the addition of "[130 geographical miles from Cape Evans]" on the Nov. 15th, 1911 entry. From Dr Jones' explanation[154] (accessed in January 2015) "I don't own the microfilm version [of Scott's journal – KS] – borrowed it from Bristol for a year when I was editing the journals," it appears that Dr Jones covered up some significant edits in the published version of Captain Scott's journal. A similar action was taken by Karen May,[155] who while citing the above Captain Scott entry of Mar. 10th from Dr Jones' "unexpurgated" edition, dotted out the first italicized comment and omitted the second italicized comment altogether.

10.7. Synopsis

In this chapter, I re-analyzed the events at Cape Evans/Hut Point after Captain Scott's departure to the South Pole. A very grim picture has emerged. It appears that an insidious and tacit mutiny had taken place at the home base. Not one from the band of people, Meares, Dr Simpson, Dr Atkinson, and Cherry-Garrard were willing to risk their own lives to fulfill the orders written in October 1911 to re-supply One Ton Depôt and sledge south to meet the Captain Scott party. Everyone from that group could sledge south and effectively meet Captain Scott's party. Each explorer produced his own false excuses for staying at Cape Evans/Hut Point, or for just leaving and going back to England.

The insidious and tacit mutiny or simple disobedience of explicit orders from Captain Scott was matched with the equally deplorable blunder/deliberate lie by Roland Huntford. Evidently, in trying to discredit Captain Scott, he created the notion that Captain Scott produced multiple and contradictory orders related to his instructions to Meares.

Huntford's mix-up with Captain Scott's orders was repeated without the historical scrutiny of original sources. I have also investigated the geographical location of Captain Scott's final camp. It is now conclusive that Captain Scott's tent was at about 22 miles and not 11 from One Ton Depôt.

10.8. Appendix to Chapter 10

10.8.1. The Most Probable Path of Captain Scott's Cairn-grave Across the Barrier

In section 10.6 entitled *The 11 Miles Myth*, I analyzed all historical sources available at that time to me to find the actual (or better to say) relative locale of One Ton Depôt, and Captain Scott's final camp where they perished. Since the completion of this

section, an interview with Tryggve Gran was brought to my attention by Kristoffer Nelson-Kilger. The interview was made by Roland Huntford and published by the Observer Colour Magazine on Mar. 31st, 1974.[156]

While addressing his recollection of the search party, Tryggve Gran gave an unexpected account that it was Hooper who sighted (found) Captain Scott's last camp

> They found him just 11 miles from a food depot and plenty. 'A man called Hooper saw it first,' Gran says. 'And he said to me, "What is that?" I had binoculars, and I said "It's rather funny, but it doesn't look like a tent; it looks like a cairn." But I went up and after 10 minutes I saw it was a tent, and signalled "Come on."'

Dr Atkinson, who led the search party, remains ambivalent[157] on the issue of who found the tent. However, Charles Wright gives a precise account of his actions[158]

> Next day we found the Owner, Wilson and Bowers in their tent. To me this came as a complete surprise as I had been quite certain that we would find they had perished among the crevasses on the Beardmore Glacier. I had been plugging along my chosen course when I saw a small object projecting above the surface on the starboard bow but carried on the chosen course until we were nearly abreast of this object … I decided [it] had better be investigated more closely, but did not expect it was of great interest so told the mule train to continue south while I went over the ½ mile or so to examine what it was. [*sic*] It was the 6 inches or so tip of a tent and was a great shock.
>
> I tried to signal my party to stop and come up to me, but my alphabetical signals could not be read by the Navy and I considered it would be a sort of sacrilege to make a noise. I felt much as if I were in a cathedral and found myself with my hat on.
>
> Eventually it got across to the party that I wanted them to come in and I went to meet them, as it seemed inappropriate to camp close to the tent, which I ordered should not be touched until Atkinson and the dog party came up. I think this was about an hour later … I think the mule party behaved most properly and the usual noises of making camp were absent. I had halted them about 100 yards away from the tent and there was of course much speculation as to what had occurred. When Atch [Dr Atkinson – KS] came along and I told him the tent had been found, he took command of the future arrangements.

The sighting of Captain Scott's last camp by Charles Wright was also confirmed by Cherry-Garrard, leaving the question open as to who from the Mule Party, led by Wright and consisting of Gran, Nelson, Crean, Hooper, Williamson, Keohane, and Lashly, found the tent.

As if the reader was not confused enough already, Tryggve Gran adds a curious comment

> We have never given to anybody the right latitude and longitude, because we were afraid that people would go down and try to find them. As far as I know, I am the only one who's got the figures, because I took observations and wrote them down.

Strangely, both comments were not confronted by Roland Huntford, who plainly accepted Gran's counterfactual account, then forgot all about it when he wrote *Scott and Amundsen*. In particular, Gran's comment of not disclosing "the right latitude and longitude" of Captain Scott's resting place is peculiar from any point of view. The following questions arise:

- What would be wrong if people would try to locate, and ultimately find Captain Scott and his companions' grave on the Barrier?,
- If Gran and the rest (per Gran's usage of *we*) of the search party felt obliged to keep his recording of the actual location of Captain Scott's tent classified, then why was the location disclosed by Cherry-Garrard[159], Dr Atkinson[160], and Lt Evans[161] to be 79°50′S?,
- Since the location of One Ton Depôt was precisely known (see Table 10.5), and since everyone was insisting that the Captain Scott tent was 11 miles from it, what was the point of not giving the precise location of the tent?

Certainly the Ross Sea Party, a supporting component of Lt Shackleton's *Imperial Trans-Antarctic Expedition* (*Endurance Expedition*) 1914–1917, while traversing the Barrier along the Captain Scott route, did not spot the cairn. It is hard to believe that it went down due to the wind and/or temperature. It rather drifted away from its actual position due to the continuous flow of the Barrier.

However, if we trust Gran's comment that it was him who measured the final location of Captain Scott's tent, and if we correlate it with the Note left at the cairn over the bodies giving the location of the tent as 79°50′S [*sic*], then inevitably one arrives at the conclusion that the tent was about 22 miles from One Ton Depôt, as Gran is obviously referring to the 11 miles myth created by Captain Scott and

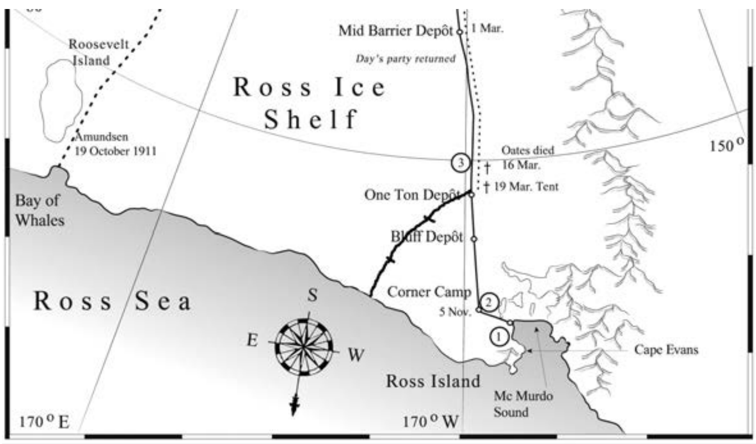


Figure 10.10. A map of the northern part of the Ross Ice Shelf, with the most probable path (solid black line) of Captain Scott's tent initially located at about 79°50′S and 170°E (–79.8333, 170.0) in 1912, and its final location at about –77.530, 173.812 (~77°32′S, ~172°49′E) in the year of 2201 (about 288 years from 1913). The two short lines crossing the main path of the grave indicate its approximate location in 2012 and 2112, respectively. The calculations were performed under the assumption of current ice flow velocities and the current position of the Barrier edge.

the expedition members never knowingly contradicting it. This further supports the analysis presented in section 10.6 that the final resting place was at a distance of **22** miles from One Ton Depôt.

In conjunction with the above, an interesting question arises as to where today Captain Scott and his comrades' grave is located at the Ross Ice Shelf. We that the Barrier is moving toward the Ross Sea. However, this general knowledge was not sufficient to predict the actual position of Captain Scott's tent. Not until recently, when new techniques based on satellite radar interferometry[162] and/or high-accuracy and high-resolution laser altimetry[163] have been successfully used to map ice velocities in Antarctica. The respective data are freely available from NASA's MEaSUREs Research Project.[164]

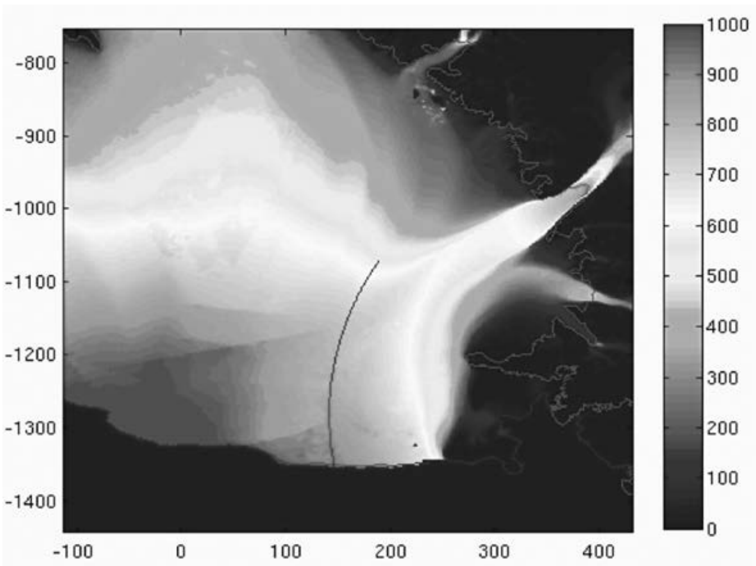


Figure 10.11. Current (2011) ice velocity in meters/year (expressed in colors on the right-hand side of the figure) at the Ross Ice Shelf in polar stereographic coordinates. An approximate path of Captain Scott and his comrades' grave is shown in a black curve from approximately One Ton Depôt to the edge of the Barrier west of Ross Island, with its northern coastline with Cape Bird and McMurdo Sound in the lower right corner. On the right side of the figure, Barne Inlet is clearly visible, with the mighty Byrd Glacier pumping the ice. The final location of Captain Scott's grave is estimated to be –77.530, 173.812. The calculations were performed in the following way using the initial data (http://nsidc.org/data/measures/data_summaries.html) of E. Rignot, J. Mouginot, and B. Scheuchl, *Ice Flow of The Antarctic Ice Sheet*, Science **333**(2011)1427–1430.

(1) Find from NASA data the initial ice velocity (υ_x and $\upsilon_y)_1$ for the original location of the grave (79°50′S, 170E), (2) calculate a new location after say 0.1 year using the initial velocities, (3) find a new geographical location and find respective ice velocities (υ_x and $\upsilon_y)_2$ at this location from NASA data, (4) repeat (go to point (2)) calculation of a new location, and iterate until the final location at the edge of the Barrier.

Using these data, I attempted to calculate the most probable path of Captain Scott and his comrades' cairn-grave. The result of this is depicted on Fig. 10.10 and 10.11. According to these calculations, Captain Scott and his comrades' bodies will reach the edge of the Barrier in the year 2201.

Responding to Gran's concerns, I am quite certain that it is possible to localize and find Captain Scott, Dr Wilson and Lt Bowers' grave if one would be willing to do so. Although it is well under the current surface, some techniques may be used to determine the location. Since the record of the location of the Captain Scott party in the note signed by the members of search party was placed in "a metal cylinder" a metal detector may be used. Also, ground-penetrating radar could be used.

10.8.2. IV. – Instructions for Dog Teams[165]

The following are instructions written by Captain Scott in October 1911 and presented to Cecil Meares and Dr Simpson, respectively. These orders were taken from Lt Evans' book – *South with Scott* – originally published by Collins in London in 1921.

October 20. Dear Meares, – In order that there may be no mistake concerning the important help which it is hoped the dog teams will give to the Southern Party, I have thought it best to set down my wishes as under: Assuming that you carry two bags of oilcake to Hut Point, I want you to take these with five bags of forage to Corner Camp before the end of the month. This will leave two bags of forage at Hut Point. If the motors pass Hut Point en route for the Barrier, I should be glad to get all possible information of their progress. About a day after they have passed if you are at Hut Point I should like you to run along their tracks for half a day with this object. The motors will pick up the two bags of forage at Hut Point – they should be placed in a convenient position for this purpose.

The general scheme of your work in your first journey over the Barrier has been thoroughly discussed, and the details are contained in Table VIII of my plan of which you should have a copy. I leave you to fix the date of your departure from Hut Point, observing that I should like you to join me at One Ton Camp, or very shortly after.

We cannot afford to wait. Look for a note from me at Corner Camp. The date of your return must be arranged according to circumstances. Under favourable conditions you should be back at Hut Point by December 19 at latest.

After sufficient rest I should like you to transport to Hut Point such emergency stores as have not yet been sent from Cape Evans. At this time you should see that the Discovery Hut is provisioned to support the Southern Party and yourself in the autumn in case the ship does not arrive. At some time during this month or early in January you should make your second journey to One Ton Camp and leave there: 5 units X.S. ration. 3 cases of biscuit. 5 gallons of oil. As much dog food as you can conveniently carry (for third journey). This depot should be laid not later than Jan. 19th, in case of rapid return of first unit of Southern Party.

Supposing that you have returned to Hut Point by Jan. 13th, there will be nothing for you to do on the Southern road for at least three weeks. In this case, and supposing

the ice conditions to be favourable, I should like you to go to Cape Evans and await the arrival of the ship. The ship will be short-handed and may have difficulty in landing stores. I should like you to give such assistance as you can without tiring the dogs.

About the first week of February I should like you to start your third journey to the South, the object being to hasten the return of the third Southern unit and give it a chance to catch the ship. The date of your departure must depend on news received from returning units, the extent of the depot of dog food you have been able to leave at One Ton Camp, the state of the dogs, etc.

Assuming that the ship will have to leave the Sound soon after the middle of March, it looks at present as though you should aim at meeting the returning party about March 1 in Latitude 82 or 82.30. If you are then in a position to advance a few short marches or "mark time" for five or six days affecting your object.

You will carry with you beyond One Ton Camp one X.S. ration, including biscuit and one gallon of paraffin, and of course you will not wait beyond the time when you can safely return on back depots.

You will of course understand that whilst the object of your third journey is important, that of the second is vital. At all hazards three X.S. units of provision must be got to One Ton Camp by the date named, and if the dogs are unable to perform this service, a man party must be organised.

(Signed) R. F. Scott.

10.8.3. II. Instructions to Dr G. C. Simpson[166]

My Dear Simpson, – In leaving you in charge of the Cape Evans Station I have little to do beyond expressing the hearty wish that all may be well with yourself and the other members of the Expedition remaining with you. I leave in your charge a box containing instructions for the Commanding Officer of the "Terra Nova" and other documents which I wish you to deliver to the proper persons.

I think you are fully aware of my plans and wishes, beyond their expression in the various statements you have seen, and that it is needless to go further with written explanations.

As you know, it is arranged for Ponting, Hooper, and Anton to make a journey to the S.W. in December. Ponting will leave with you a written statement giving an outline of his intended movements. Later in the season he will probably visit Cape Royds and other interesting localities: please give him what assistance you can in his important work.

From time to time Meares may be visiting the station, and I hope that by this means, or through the telephone, you may receive information as to the progress of

the Southern Party. The thawing of the drifts in summer will have to be carefully watched and such measures as are necessary taken to avoid injury to the Hut and the stores. Cases should not be exposed to wet or tins to rust. The breaking of the sea ice should be carefully watched, noted, and reported to Hut Point when possible. Bowers will leave notes with you concerning store requirements and desirable expenditure. I anticipate the ship may have some difficulty in re-provisioning the station. You will of course render all the assistance you can.

Details as to the improvement of the Hut for a second winter will become more evident as the season advances. In addition to the probable renovation of the stables I can only suggest the following points at present:

1. An extension or rebuilding of the entrance porch so that the outer door faces north. Regard must be had to the possibility of bringing sledges into hut.
2. A shelter extension to latrine.
3. The construction of an air-tight embankment or other device at the base of the hut walls to keep the floor warmer.
4. The betterment of insulation in your corner, and the provision of a definite air inlet there.
5. The caulking of small holes and slits in the inner roof.
6. The whale boat should be looked to and probably filled with water under advice from ship.

After departure of Southern Party all mattresses and bedding should be rolled up, and as opportunity occurs they should be thoroughly dried in the sun. You will remember that as the summer advances certain places in the solid floe become dangerously weak. It should be well to keep watch on such places, especially should they occur on the road to Hut Point, over which parties may be travelling at any time. It is probable there will be a rearrangement of the currents in the region of Tent Island since the breaking of the Glacier Tongue.

(Signed) R. F. Scott.

Volume III

Chapter 11

Captain Robert F. Scott: An Apology

"Now suppose," chortled Dr Breed, enjoying himself, "that there were many possible ways in which water could crystallize, could freeze. Suppose that the sort of ice we skate upon and put into highballs – what we might call ice-one – is only one of several types of ice. Suppose water always froze as ice-one on Earth because it had never had a seed to teach it how to form ice-two, ice-three, ice-four …? And suppose," he rapped on his desk with his old hand again, "that there were one form, which we will call ice-nine – a crystal as hard as this desk – with a melting point of, let us say, one-hundred degrees Fahrenheit, or, better still, a melting point of one-hundred-and thirty degrees."

Kurt Vonnegut, *Cat's Cradle*[1]

Either something is authentic or it is unauthentic, it is either false or true, make-believe or spontaneous life; yet here we are faced with a prevaricated truth and an authentic fake, hence a thing that is at once the truth and a lie.

Stanisław Lem, *A Perfect Vacuum*[2]

The most merciful thing in the world, I think, is the inability of the human mind to correlate all its contents. We live on a placid island of ignorance in the midst of black seas of infinity, and it was not meant that we should voyage far. The sciences, each straining in its own direction, have hitherto harmed us little; but some day the piecing together of dissociated knowledge will open up such terrifying vistas of reality, and of our frightful position therein, that we shall either go mad from the revelation or flee from the light into the peace and safety of a new dark age.

H. P. Lovecraft, *The Call of Cthulhu*[3]

When I started to think about and write this chapter, something strange occurred to me. I realized that my time devoted to re-analyzing the *Terra Nova Expedition* was about two times longer than its actual preparation and execution. It proves either

I was slow in my work, or – and what it is most probable – the expedition was prepared and run in a very effective way.

Captain Scott's expeditions, like any human undertakings – even recent ones – which have exploratory aspects were bound to run into many different troubles and difficult times. Both of Captain Scott's expeditions, but especially the *Terra Nova Expedition,* were life-threatening bold endeavors. They were highly complex logistical undertakings where humans, animals, machines, and nature played their roles. In some respects, Captain Scott's methods were archaic, but in other respects they were innovative and ahead of their time.

Figure 11.1. When heroes meet with disaster: A petulant and defensive 1913 cartoon. For clarity the following descriptions are deciphered: (1) M^{R} COSY CORNER SAYS WHAT HE WOULD HAVE DONE IN LIKE [similar – KS] CIRCUMSTANCES, (2) SIR EASY POINTS OUT WHAT OUGHT TO BE DONE, (3) M^{R} TOM TIT DECLARES HOW DIFFERENTLY HE WOULD HAVE ACTED, (4) M^{R} TIMID FAWN PROVES (TO HIS OWN SATISFACTION) THAT ALL WOULD HAVE GONE WELL IF HE HAD BEEN THERE, (5) M^{R} MONEY-GRUB STAY-AT-HOME WANTS TO KNOW WHY SO AND SO WASN'T DONE, (6) AND MANY OTHERS HAVE MANY ILLUMINATING THINGS TO SAY ON THE SUBJECT.

For many who wrote books and articles, and for those who just had an opinion, Captain Scott was an easy target for criticism. For others, Captain Scott was a hero whose achievements are beyond questioning. For these impractically minded people, Captain Scott was a central figure in exploration.

The current chapter, although initially designed as a short apology, evolved into several subsections, and then into a new research project combined with the results of previous chapters, which are also summarized in here. A word of caution must be added about the current chapter title and thus my intentions. Here the word *apology* has a double meaning: (1) an expression of regret for having done or said something wrong and (2) something that is said or written to defend something that other people criticize.[4] In what follows I will present an analysis supported by justification and/or defense of all significant factors/events which, according to Captain Scott and various historians, were responsible and/or lead to the South Pole party's disaster.

I will analyze each factor which *could* lead any expedition to final disaster by representing contributing factors as different masses placed on a drum membrane of certain breaking strength. Initially, the membrane will bend (deform its shape) under the influence of different masses, confirming that all masses (physical factors) in different degrees influence its initial strain (stretch). As the expedition progresses, some of the masses may diminish, some may increase, and some additional masses may appear on the membrane as in any dynamic process. The membrane has its own physical characteristic, represented by its rupture strength or ultimate tensile strength. Thus, if the summary weight of these masses exceeds the rupture strength of the membrane, the membrane breaks. Of course, the weight of the masses is not uniformly distributed.

This chapter, for clarity of presentation, is divided into three main sub-chapters. In the first sub-chapter, which consists of 14 secondary subdivisions, I will rebut, in the above-mentioned context, the causes of disaster accounted by Captain Scott and various authors. In the following sub-chapter, I will consequently show that not long after reaching the Pole, the Captain Scott party axiology dramatically changed. And in the last sub-chapter, I will analyze four causes of disaster (food and fuel shortages, and the *Extreme Cold Snap* and the *Never Ending Gale*) which did not happen, contrary to Captain Scott's accounts.

11.1. The Causes of the Disaster – Rebuttal

Ever since the *Terra Nova* returned from Antarctica in 1913, a great number of causes for the disaster have been offered, proposed and widely discussed. However, it was Captain Scott himself in his *Message to the Public* who first presented a number of reasons for not being able to return to home base[5]

> The causes of the disaster are not due to faulty organisation, but to misfortune in all [the] risks which had to be undertaken.
> 1. The loss of pony transport in March 1911 obliged me to start later than I had intended, and obliged the limits of stuff transported to be narrowed.
> 2. The weather throughout the outward journey, and especially the long gale in 83°S., stopped us.
> 3. The soft snow in lower reaches of glacier again reduced pace.

A few lines later, Captain Scott reveals the real cause of disaster according to him[6]

> But all the facts above enumerated were as nothing to the surprise which awaited us on the Barrier. I maintain that our arrangements for returning were quite adequate, and that no one in the world would have expected the temperatures and surfaces which we encountered at this time of the year.

These quotes mentioned above described the sources of disaster and the deaths of Captain Scott, Dr Wilson, Lt Bowers, and perhaps Captain Oates, according to Captain Scott. I think that Captain Scott did not assume that the death of P. O. Evans was in any way related to the above-mentioned issues.

However, a question remains of the *real* cause or *additional* causes of the disaster, which has perplexed almost every polar enthusiast, and certainly every author writing about Captain Scott and his expedition. Thus, the causes of disaster were multiplied by uneducated guessing, or by simply adding new points to already existing ones[7]

> It was not faulty logistics that did for Scott, not lack of food or fuel, not washers, not Meares taking more than his share, not imprecise instructions, not over-rigid instructions, not arrogance, not stupidity, not the fifth man, not scurvy, but the weather.
>
> …
>
> They had been, quite literally, killed by the cold – a one in ten chance, Simpson conservatively [*sic*] estimated.

We already know that the author of the above statement, David Crane, was dead wrong. His easiness and carelessness in finding reasons are just literary locutions. Dr Simpson never wrote the above: it is a misattribution of Cherry-Garrard's rhetorical statement "Nine times out of ten, says the meteorologist, he would have come through: but he struck the tenth."[8]

Over time, the above list has been enlarged by additional causes for the disaster. In what follows, I will critically examine the causes which appear to be the most important. The investigative reader certainly will notice that a good part of the analysis presented below will be a summary of what was addressed in the previous chapters. However, new material will also be presented. The following subsections will bear abbreviated titles of the possible "causes of the disaster". The order of subsections does not reflect the possible impact on Captain Scott's party performance – it rather reflects their time of possible impact.

11.1.1. The Loss of Ponies in March 1911

Let me recall the exact entry on this matter in his *Message to the Public*

> 1. The loss of pony transport in March 1911 obliged me to start later than I had intended, and obliged the limits of stuff transported to be narrowed.

It is indeed a curious entry by Captain Scott and a hard one to understand. What is the relationship between the number of ponies and the date of the start of the *South Pole Journey*? Lt Shackleton at the beginning had fifteen ponies, however when he started his *South Pole Journey* on Nov. 3rd, 1908, he used only four Siberian

ponies pulling sledges loaded to a total weight of 600–660 ℔ (~272–299 kg) each. Captain Scott had originally nineteen ponies, and his South Pole cavalcade including ten ponies departed from Hut Point on Nov. 3rd, 1911 (see Tab. 11.1).

Right after the quarters at Cape Evans became habitable on Jan. 18th, 1911, Captain Scott ordered depôt-laying on the Barrier to prepare for the upcoming journey to the South Pole. On Jan. 27th a cavalcade of 12 men, the 8 fittest ponies, and two dog teams of 13 dogs each departed. Due to a number of events the Depôt Party returned with only two ponies named Nobby and James Pigg. Altogether 10 ponies were ready for the next sledging journey. Because Captain Scott never voiced any concern that he only had ten ponies to drag sledges during the *South Pole Journey*, it appears that the number of ponies at Captain Scott's disposal was satisfactory. Moreover, during the depôt laying as well as during the *South Pole Journey*, Captain Scott did not complain

Table 11.1. Nicknames of ponies initially departing from New Zealand and perished at various stages of the *Terra Nova Expedition*: during the sea voyage to Antarctica, during the depôt laying in summer 1911 and during the actual *South Pole Journey*.

	Initial ponies who left New Zealand	**Died during sea voyage**	**Died during depôt laying**	**Died during South Pole journey**
1	Blossom		Blossom	
2	Blücher		Blücher	
3	Bones			Bones
4	Chinaman			Chinaman
5	Christopher			Christopher
6	Davy	Davy		
7	Guts		Guts	
8	Hackenschmidt		Hackenschmidt*	
9	James Pigg			James Pigg
10	Jehu			Jehu
11	Jones	Jones		
12	Michael			Michael
13	Nobby			Nobby
14	Punch		Punch	
15	Snatcher			Snatcher
16	Snippets			Snippets
17	Uncle Bill		Uncle Bill	
18	Victor			Victor
19	Weary Willie		Weary Willie	

* The pony named Hackenschmidt was reported dead to Captain Scott on Apr. 13th, 1911.

or report about food shortages *according to* his 144-days sledging plan. Thus, the depôts were adequately spaced and supplied with the expected food and fuel rations.

Establishing the actual number of ponies available during the various stages of the *Terra Nova Expedition* to Captain Scott is not a simple task. In Tab. 11.1, I collected all relevant information as for the initial number and subsequent deaths of the ponies. While looking at this table, one must notice that on the contrary to Captain Scott's judgment presented in the *Message to the Public*, the dead ponies along Captain Scott's return route meant salvation to his party. This is indeed an unexpected and important reflection. In the following small Tab. 11.2, I accounted for the ponies (Blücher and Blossom)[9] which perished along Captain Scott's route on the Barrier during depôt-laying from Jan. 27th through Mar. 5th, 1911, and the ponies which perished during the Barrier leg of the *South Pole Journey*. For comparison, I have added a column with the dates of when Captain Scott's returning party reached the locations where the ponies' cutlets were stored. Thus from Feb. 17th all returning parties, Captain Scott's party in particular, had a plethora[10] of pony cutlets to consume.

This inference, combined with the results presented in upcoming subsection 11.1.10 and entitled *Food Shortages on the Barrier*, provides new evidence that Captain Scott's alleged food shortages were non-existent.

Table 11.2. List of the ponies that perished on the Barrier along the Captain Scott party's return route.

Pony Nickname	Death date 1911	Death location	Captain Scott's arrival at the ponie's location
Blücher	Feb. 13th	~79°S	–
Blossom	~Feb. 16th	~78°40′S	–
Jehu	Nov. 24th	81°14′S	Mar. 3rd
Chinaman	Nov. 28th	82°19′S	Feb. 26nd
Christopher	Dec. 1st	82°47′S	Feb. 23rd
Victor	Dec. 3rd	82°59′S	Feb. 22nd
Michael	Dec. 4th	83°20′S	Feb. 19th
Bones James Pigg Nobby Snatcher Snippets	Dec. 9th Shambles Camp	83°30′S	Feb. 17th

In only one case, One Ton Depôt, the depôted food/fuel rations were not as required, and it was necessary to supply this depôt at a later date with an additional 5 X.S. rations to be used by returning parties. In Chapter 10 and in its subsection 10.8.1, I presented a discussion of Captain Scott's written orders to ensure that these additional rations would have been swiftly depôted by Meares or some other party as per orders issued to Dr Simpson. Captain Scott's orders were entirely ignored by

the evident mutineers Cecil Meares and Dr George Simpson, who was in charge of Cape Evans/Hut Point. The same orders were not followed by Dr Atkinson, who assumed command of Cape Evans after Dr Simpson's escape. Dr Atkinson and Cherry-Garrard later launched the First and the Second Relief Parties without any real (genuine) desire of sledging south. Cherry-Garrard pointlessly stayed on at One Ton Depôt for six days, and later formulated a number of weak excuses of not sledging further down South. In a similar manner, Dr Atkinson after venturing to Corner Camp on Mar. 30th, 1912, against all rationale available to him at that time (144-days schedule + delays) *post factum* proclaimed "I was morally certain that the polar party had perished."[11]

Indeed, Dr Atkinson was hypocritically "morally certain" that Captain Scott's party perished right on Mar. 30th, 1912. However, the investigative reader may sneeringly say that it was morally and physically certain that on this day, and without *ex-ante* food/fuel rations previously deposited at One Ton Depôt, *no one* from the Captain Scott party could have survived.

From *post factum* knowledge, we will soon know that even if the rations had been delivered on time and as requested in Captain Scott's written orders given to Meares and Dr Simpson, the Captain Scott party was to perish anyway. However, back in February – March 1912, no such knowledge was available and the tacit mutiny occurred at Cape Evans/Hut Point. If the Captain Scott party was sledging as it was outlined to everyone before its departure, the mutiny was practically a death sentence.

In Chapter 9, I presented a detailed analysis of distances and food/fuel rations allocated to the Captain Scott party. It was shown there that by changing sledging velocity, Captain Scott was running according to his contingency plan of changing sledging velocity. On Figs. 9.3 and 9.4, I depicted that until Feb. 2nd the Captain Scott party was well ahead of schedule. However, after that date the party was systematically decreasing its sledging velocity and steady falling behind the schedule. Finally, the party was well behind schedule and thus short of food and fuel.

One should also keep in mind that due to the physical as well as mental effort, despite consuming full sledging rations the Captain Scott party was in want of food for its additional calories, vitamins, and simple variety.

The investigative reader should also observe that a dissimilar account to that given in the *Message to the Public* was made by Captain Scott in his written orders to the Commanding Officer of *Terra Nova* in October 1911[12]

> The expedition suffered a considerable loss of ponies in March, but enough remain to carry out the Southern Plan, under favourable circumstances.

The difference between these two comments by Captain Scott is that in October 1911, he was certain that the number of remaining ponies was enough "to carry out the Southern Plan," while in March 1912 he was, on the contrary, suggesting that it "obliged the limits of stuff transported to be narrowed". Also of note is Captain Scott's vague qualifier "under favourable circumstances", whatever that meant.

Therefore, I think that Captain Scott's comment (from the *Message to the Public* account) is inapplicable, and in no way contributed to the deaths of the Captain Scott party.

11.1.2. (79°28½′S, 170°E)

There are at least four issues related to the One Ton Depôt (79°28½′S, 170°E) placement:

- Captain Scott's inability to establish One Ton Depôt at 80°S,
- Captain Oates' seemingly prophetic remark that Captain Scott will regret placing One Ton Depôt at 79°29′S instead of 80°S,
- Reaching the One Ton Depôt meant salvation for the returning Captain Scott party according to popular wisdom,
- The actual and relative location of One Ton Depôt and Captain Scott's last camp.

All of the above issues are artificially created problems to show someone's superficial insight into the subject. I have already discussed in the previous chapters, in a number of different contexts, the issue of One Ton Depôt's placement. Here, I will present a summary of the previous accounts, with additional comments.

It is interesting how a seemingly featureless geographical location (79°28½′S, 170°E)[13] on the endless snow-white Barrier grew into the *sui generis* spot of Captain Scott's *Terra Nova Expedition*. However, it was and still is false and counterfactual to nominate the unique characteristics of the 79°28½′S, 170°E location.

The only reason for selecting the 79°28½′S, 170°E location (for more see section 10.6) resulted from Captain Scott's 144-days schedule and related logistics. Lt Shackleton established, due to the same reasons, his Depôt A[14] at 79°36′S and 168°E. Thus, Captain Scott's One Ton Depôt was fairly close (23 miles (43 km)) to Lt Shackleton's Depôt A. However, contrary to the notion attributed to the Captain Scott party, the parties of Lt Shackleton, and the First and Second Return Parties, did not find anything specific, unique, or special about the location of Lt Shackleton's Depôt A or Captain Scott's One Ton Depôt.

Since One Ton Depôt was established on Feb. 17th, 1911, and along with Captain Scott's comment "we have landed considerably over a ton of stuff. It is a pity we couldn't get to 80°" it became a false catharsis to many *Terra Nova Expedition* members, to Captain Scott himself, and to his storytellers.

These Captain Scott storytellers – like for example Sir Ranulph Fiennes – eagerly and with mystical notions accounted for the location of One Ton Depôt[15]

> Many years later Gran described in his book the conversation he thought [*sic*] took place between the two officers. 'Oates proposed to Scott that the animal ("Weary Willie") should be killed and that we should push on with the other ponies, but Scott rejected this question. He had, as he himself put it, felt quite sick on account of the animal's suffering … [Oates said] "Sir I'm afraid you'll come to regret not taking my advice." "Regret it or not," replied Scott, "I have taken my decision, as a Christian gentleman."
> So that was that. The depot was made not at 80° South but at 79°29′ South, some thirty-one miles to the north. A great deal was later to be made of this deficiency of thirty-one miles [*sic*].

This is indeed a mystical and tantamount account of the actual and *post factum* knowledge. Let me look more closely at Sir Ranulph's comments. Is it possible that

31 miles out of 1498 or 1380 miles could play a crucial role in Captain Scott's faith? These 31 miles represent about 2% of the total sledged distance. Did Captain Scott fall into the trap of "trying to accomplish something big, not realizing that life is made up of little things"?

Let me ridicule Sir Ranulph's reflections by presenting a chain of thought leading to a *reductio ad absurdum*. In section 2.3, in relation to Cherry-Garrard's analysis of possible return dates to One Ton Depôt, I presented two scenarios. These scenarios were elaborated to show the possibilities of how Cherry-Garrard could estimate possible dates of Captain Scott's party arriving at One Ton Depôt. From Fig. 9.1, one can see that despite initially sledging ahead of schedule, the Captain Scott party while moving toward One Ton Depôt was gradually moving more and more slowly. Therefore, if the party did not stop (slow down) before reaching One Ton Depôt, the party most probably could have arrived there on or about Mar. 20th.

The actual amount of food stored at One Ton Depôt after Cherry-Garrard's belated delivery was sufficient for the returning Captain Scott party to sledge back to Hut Point at a distance of 118 miles, which is equivalent to about 11 sledging days. However, on Mar. 21st through 29th, 1912 – the *Never Ending Gale* as reported by Captain Scott started, and the party was pinned down in the tent for the next nine/ten days, supposedly consuming all of their rations. Since the rations assigned to Captain Oates and P. O. Evans were not used (see subsection 11.1.10), the Captain Scott party at the end of the *Never Ending Gale* (see Chapter 8) would have had about 11 days rations (food and fuel). Thus on Mar. 30th, 1912, Captain Scott, Dr Wilson and Lt Bowers could have continued sledging northward to Hut Point. By reducing daily rations to ⅔, they could have arrived at Hut Point on Apr. 10th, 1912. And all of this under the seemingly unrealistic assumptions of 10.1 miles/day marches and no weather delays between Mar. 30th – Apr. 10th.

From Fig. 9.1 one can readily observe that since reaching the Beardmore Glacier, the Captain Scott party sustained a sledging velocity which was steadily decreasing to a wretched 6 miles per day.

Consulting meteorological data recorded at Cape Evans for the period of Mar. 30th – Apr. 10th, 1912, one may certainly doubt that sledging would have been possible for the period from Apr. 7th until 9th, as depicted on Fig. 11.2. Pending the previous analysis of wind events, one has to be careful in making generalizations. However, this figure may suggest that at least for three days (Apr. 7th until 9th) blizzard conditions were present at Cape Evans. Consequently, one may venture and extend this suggestion to suggest that similar conditions were present on the Barrier.

To an uneducated observer, these possible blizzard conditions certainly would have pinned down the Captain Scott party and further limit food/fuel rations. However, if the above is highly speculative, one has to recall Captain Scott's entry on Mar. 18th "My right foot has gone, nearly all the toes" it appears that regardless of weather conditions Captain Scott's end was not far away. However, even if Captain Scott was somehow alive, it is difficult to imagine that the party could sledge with velocities higher than about 6 miles/day as depicted on Fig. 11.9. This combined with the *Never Ending Gale* and limited food/fuel supplies would mean certain death for the party.

Therefore, any uneducated person thinking that reaching One Ton Depôt meant salvation for the Captain Scott party is in grave error. It also must be noted that in conjunction with this conclusion, as I discussed in more detail in section 10.6, the

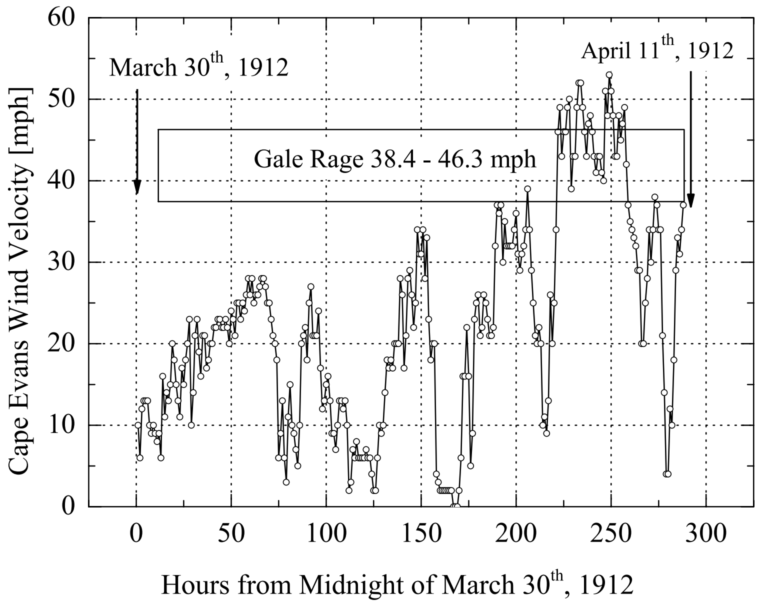


Figure 11.2. Wind velocity recorded at Cape Evans station between Mar. 30th and Apr. 10th, 1912.[1] Although the wind velocity at Cape Evans is not a mirror image of wind events along the route to and from One Ton Depôt it may suggest changes in wind conditions along that route.

[1] George C. Simpson, *Meteorology*, Vol. III, Tables, Harrison and Sons, Ltd., London, 1923, *cf.* p. 15–18.

actual location of Captain Scott's last camp was (79°50′ ± 1′)S, 169°22′E (see Tab. 10.6) which is about 21–22 miles from One Ton Depôt.

In summary, observations such as[16]

> Had One-Ton Depot been placed at latitude 80°S., as planned, Scott and his two surviving companions could have reached it on their return march. Instead, because of the weakness of the ponies, it was placed some 31 miles short of there. Scott's party died only 11 miles away.

should rest on dusty library shelves as uneducated guesses, and the author Walter Sullivan should apologize to the ponies.

11.1.3. Complexity of Transportation Methods

It is a widely accepted misconception that different methods of transportation were the reasons for, or a significant contribution to, Captain Scott's death during the journey to the South Pole. At first instance, when one learns that Captain Scott's South Pole cavalcade constituted motor-sledges, ponies, dogs and humans, one inevitably wonders.

It was Captain Scott who was entirely responsible for the *Terra Nova Expedition*. It was his single-minded call and was thus derived of all his knowledge, financial constraints, experiences, prejudices and superstitions.

Transportation and more importantly logistics was the *Terra Nova Expedition's* Achilles Heel. The word logistics here is used as a special case, not as in modern management, but rather as a guessing game of optimization problems. In Chapter 10.3 in relation to Dr Atkinson's participation in the tacit mutiny at Cape Evans, I estimated that *self-sustained* man-hauled sledging distance was about $2 \times 400 = 800$ miles. It was about the actual distance (2×410 miles) made by Captain Scott and his comrades who man-hauled from the foot of Beardmore Glacier (–83.3333) to the South Pole and back, from Dec. 8th, 1911 until Feb. 19th, 1912. Although the Captain Scott party was partly supported by the First and the Second Return Parties, one can fairly assume that the distance $2 \times 400 = 800$ miles represents a feasible figure of self-sustained man-hauling.

However, the distance for a round trip from the possible base camps at the Barrier edge to the South Pole is 100 miles less than the doubling of the 800 miles of possible self-sustained man-hauled sledging. Consequently, the explorers who were thinking about reaching the South Pole were forced to figure out the method of supporting the final party during the initial and final ~350 mile legs of their journey.

Both Captain Scott and Captain Amundsen recognized this basic fact, which was successfully implemented by Lt Shackleton during his South Pole attempt. Thus for Captain Scott, Lt Shackleton's journey was a blueprint, and he needed to ensure that during all stages, and especially the final one, his party would not, like Lt Shackleton's, be short of food/fuel.

However, and contrary to the common belief presented in all accounts of the *Terra Nova Expedition*, Captain Scott's planning did not rest on coping with Lt Shackleton's transport methods, but rather on his assumption of possible minimal and sustainable sledging velocity during his *South Pole Journey*. Whatever transport method Captain Scott selected, its underpinning assumption was the minimal and sustainable sledging velocity. According to this fundamental assumption, all remaining issues were set up and followed.

During the *Discovery Expedition* (1901–1903), rather than wandering a short distance over the Barrier, the Captain Scott Party (Scott, Wilson and Shackleton) covered 833 miles in 93 days, reaching the Farthest South of 82°17′S. It meant that their sustained sledging velocity was about 9 miles/day.

I have already, on a number of occasions, discussed the bad advice of Admiral Sir Francis Leopold McClintock to Captain Scott on sledging dog food rations during the *Discovery Expedition*. His advice was to take half of the weight of food that was actually needed by the dogs, see Table 10.6. This was a nearly fatal error for Captain Scott's party during the 1902 *Southern Journey*, and entirely changed the history of the South Pole's attainment. If the dogs during the 1902 *Southern Journey* were fed as required despite the team not being able to handle the dogs properly, I believe that Captain Scott and/or Lt Shackleton would certainly have appreciated their value in Antarctic exploration earlier. None of that happened, and when events gave him the next move, Lt Shackleton resorted to ponies as a means of transportation.

For the *Nimrod Expedition* (1908–1909), Lt Shackleton estimated that his team's (Shackleton, Wild, Marshall and Adams) South Pole attempt would last for 93 days, with the possible extension of food rations up to 120 days. It meant that Lt Shackleton was assuming the range of sustainable sledging velocity to be $749 \times 2/93 = 16.1$ miles/day and $749 \times 2/120 = 12.5$ miles/day, respectively. In reality, it turned out to be 11.1 miles/day $(749 - 97.5) \times 2/117)$.

It is indeed an impressive increase of sledging velocity (11.5 from 9 miles/day, about 30% increase) that was made by Lt Shackleton over the *Discovery Expedition*. Despite that, Lt Shackleton was short on food rations and had to turn back before the South Pole. Due to poor pony performance, and the death of the last pony named Socks who fell down into a crevasse on Dec. 7th, 1908, the party from the foot of the Beardmore Glacier relied on man-hauling.

Thinking in terms of self-sustained man-hauling distance, it must have occurred to Captain Scott that the leg from the foot of the Beardmore Glacier to the South Pole and back could only be self-sustained if the final party was assisted by supporting parties to make sure of adequate and sufficient food and fuel rations along the route. Thus, the plan of the 144-days schedule was envisioned. Its foundation was based on an assumption of a low (modest) *sustainable sledging velocity* during the 144-days journey of about 10.1 miles/day. This low daily sledging velocity was Captain Scott's most important contingency plan during his *South Pole Journey*.

The *South Pole Journey* was divided into two stages: the Barrier, and beyond toward the Pole, where according to Captain Scott's irrational belief, no animals (dogs or ponies) could be used effectively. As for means of Barrier transportation, Captain Scott decided to use ponies.

The investigative reader may recall that altogether sixteen men with two tractors, a dog team, and ten ponies initially formed Captain Scott's South Pole echelon. However, well before departure to the South Pole it was clear to Captain Scott that the two remaining tractors would likely not play any significant part in the adventure. One must observe that it was Captain Scott who made the detailed plans for the *South Pole Journey*. These plans included all elements and their distribution along the route and the time. On Oct. 27th, 1911, Captain Scott clearly described his intentions and plans

> The motor [tractor – KS] programme is not of vital importance to our plan and it is possible the machines will do little to help us, but already they have vindicated themselves. Even the seamen, who have remained very sceptical of them, have been profoundly impressed.

The issue of dogs as draught animals was based on Captain Scott's past experiences, and the dogs were to perform auxiliary sledging trips as it was described in orders given to Cecil Meares (see Chapter 10.2 and 10.8.1). Towards the end of the Barrier journey, for a limited time and just before returning, the dogs were used to briefly support the main Captain Scott party. For that reason, the dogs did not participate in a meaningful way on the South Pole Journey. In relation to work done by ponies, one must observe that they participated in only 23% of the entire planned *South Pole Journey*.

I am not arguing here that the dogs, if handled properly, were not superior over any other means of transportation in Antarctica in the early twentieth century. Their usefulness was palpable and proven many times in the Arctic and Siberia by explorers and in daily use by native peoples. I am arguing that the basic transportation of supplies during Captain Scott's *South Pole Journey* was mainly done by man-hauling, and the rest (outward Barrier stage) representing about 23% of the entire trip was supported by ponies and dogs. Therefore, the alleged notion that Captain Scott's transportation means and methods were complex, and thus somehow contributed to the Party's deaths, is rather unfounded. I am also not arguing that even very limited

usage or support of motor sledges and the dogs did not create a nuisance and certain disruption to Captain Scott's initial Barrier stage.

From Captain Scott's conception of man-hauling to the South Pole, as compared with Captain Amundsen's dog sledging and skiing, he was fighting a losing battle. Adding the effective racing element (including Captain Amundsen's desisted start in September 1911), Captain Scott was left even further behind in the field.

The investigative reader may observe that Captain Amundsen was frequently praised, contrary to Captain Scott, for using dogs and only dogs in his dash to the South Pole. Although such an observation is true, it is not the main reason Captain Amundsen gained superiority in moving across Antarctica. Captain Amundsen's supremacy was in his and his team's genuine technical skills and physical endurance of skiing. All of Captain Amundsen's companions were experienced and sturdy skiers – including a champion skier, Olav Bjaaland, as the front runner to lead the dogs. By skiing alongside the sledges (on the contrary to the "Russian style" (sitting on the sledge while sledging) adopted by Meares and others), the men saved weight to be used for additional food and fuel. It meant saving something like ~140 ℔, which meant ~70 daily food rations. Additionally, the natural velocity of the dogs trotting while hauling the sledge is about the sustainable velocity of a trained human skiing.

The best way to look at Captain Scott's sledging performance, and thus at detection of possible troubles with sledging arrangements and conditions, is to look at trends and its long-term behavior. One can see a parallel with terms like weather and climate. The weather is the state of the air and atmosphere at a particular time and place. The climate is the average course or condition of the weather at a given place usually over a long period (30–35 years) of time.

At many instances in this book, I have investigated the issue of temporary fluctuations and long-term changes in making judgments about Captain Scott's transportation system. The ability to distinguish between the weather and climate statements is fundamentally important. For the same reasons, the ability and indeed the obligation of recognizing the difference between short (sledging velocity) and long (*sustained velocity*) term changes and trends in Captain Scott's sledging velocity is important.

⋮

Sledging velocity. Here and in conjunction with Captain Scott's *South Pole Journey*, let me briefly look at two imaginary expeditions and their sledging progress described by the fraction of days behind/ahead of schedule. Sledging velocity is a complex variable depending upon many factors, among them: weather, surface, pulling power, sledge weight, *etc.* The mentioned factors are physical variables. For a complete picture, one has to add and consider psychological issues like the homeward effect and the behavioral effect (sleep, workload, leadership, group interaction, *etc.*) of the expedition.

On Fig. 11.3 I presented a plot of daily marches in relation to scheduled daily marches of these two imaginary expeditions called $\mathcal{A}$ and $\mathcal{B}$ respectively. These imaginary expeditions marched the same route at the same time. Let us one more time make a *cæteris paribus* assumption that the only difference between expeditions $\mathcal{A}$ and $\mathcal{B}$ is their sledging performance as indicated on Fig. 11.3.

In principle, both expeditions should sledge according to an assumed schedule which is directly related to various food and fuel depôts along both parties' routes. However, since the sledging performance of each expedition is a complex variable,

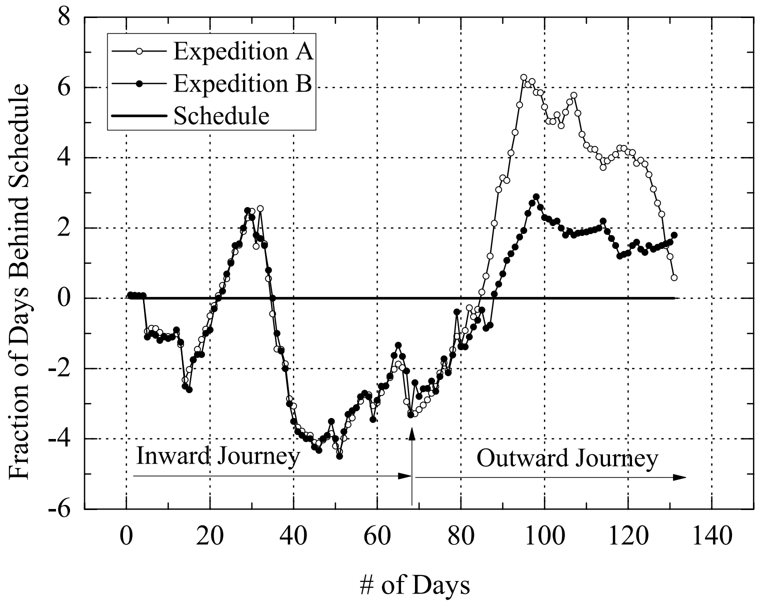


Figure 11.3. The fraction of days relative to schedule for two imaginary sledging expeditions.

it would be wishful thinking to expect sledging in accordance with the assumed schedule. In the best case scenario, allowance for possible weather-related setbacks in sledging performance would mean each expedition should sledge a few days ahead of schedule as a precaution.

The journeys are divided into inward and outward periods. Let me describe these journeys just by looking at the respective fraction of days behind the schedule as presented on Fig. 11.3.

Initially, for a couple of days, both expeditions were staying right on schedule before dropping one day behind schedule. Subsequently, both expeditions kept their scheduled pace for several days, before again dropping behind schedule. Since it is wiser to be ahead of schedule, both parties after reaching about three days lag pushed harder to recuperate lost time, and after sledging for about 15 days they found themselves to be about 3 days in advance of schedule. After that, within ten sledging days, the parties again dropped four days behind the schedule, and for the next ten days were sledging with an unchanged delay. When the delay was increasing beyond four days, both parties slowly started to regain lost distances, to return to three days delay just after reaching the end of the inward journey.

From this point, and right on the first day of the outward (home) journey, both parties day by day increased sledging distances, and slowly approached the schedule again. However, from Fig. 11.3, one can see that at just about the time both expeditions matched the expected sledging schedule, their fraction of days relative to the timetable start to substantially differ.

Expedition $\mathcal{B}$'s sledging progress seems to be rational and reflecting the homeward effect by increasing sledging velocity until they reached about three days advan-

tage. From this time on, expedition $\mathcal{B}$ stayed at about two days ahead of schedule and maintained its velocity to the end.

However, expedition $\mathcal{A}$'s plot of fraction of days relative to the schedule shows strange behavior. From the day of turning homeward, day after day the expedition was gaining time (distance) over the schedule, until they reached 6.28 days of advantage after 92 day of sledging. From that day on, with the exception of a short lived increase on the 107th day expedition, $\mathcal{A}$'s progress was diminishing day after day.

Since both expeditions sledged in the same conditions, how one would explain expedition $\mathcal{A}$'s change of fraction of days behind schedule? One could name the following reasons:

1. After reaching more than 6 days advantage, the party slowed down for the purpose of saving energy,
2. One or more members of the party were lacking in or deprived of strength or power,
3. The weather and conditions overwhelmed the party,
4. Unspecified reasons.

It is not particularly difficult to rebut the above explanations except for the first and the last one. Provided that expedition $\mathcal{A}$ was a rational undertaking, one must assume that the leader of the sledging party was also a rational person. Therefore, one must assume that the leader planned the journey with all pertinent details, including daily sledging distance (velocity), at the maximum sustainable value throughout the whole journey. Sledging both behind and ahead of schedule were potentially life threatening situations. Sledging behind the schedule would lead to a shortage of food and fuel depôted along the route according to the assumed time table schedule. Sledging ahead of schedule could potentially lead to excessive physical fatigue and a substantial deficit of calories to endure prolonged periods of pulling.

Clearly expedition $\mathcal{A}$ was in a peculiar position after reaching just a little more than 6 days advantage over the schedule. While steadily gaining over the schedule expedition $\mathcal{A}$ was more frequently arriving at food/fuel depots along their route. That simply meant an increase in their rations surplus. However, if the party was say 6 days ahead of schedule, and since the time of reaching this advantage the party did not continue to gain velocity, the party would reach the depôts with original frequency and the rations surplus would become constant. Denoting initially assumed frequency of arrival at depôts by f_{144} and relating this to the initially assumed daily sledging velocity by v_{144} one can easily figure the actual (observed) frequency f_{actual} of arriving at depôts if the sledging velocity was v_{actual}

$$f_{actual} = f_{144} \cdot \frac{v_{actual}}{v_{144}} \text{ or } \Delta f = \Delta v \cdot f_{144},$$

where $\Delta v = v_{actual} - v_{144}$ and $\Delta f = f_{actual} - f_{144}$.

The above equations reflect the relationship between the assumed and actual frequencies of visiting depôts as described in the above discussion. One can see that in the case

$\Delta v > 0$	gaining distance – frequency of depôt visiting is increasing
$\Delta v = 0$	sledging at assumed schedule – default depôt frequency visiting
$\Delta v < 0$	losing distance – frequency of depôt visiting is decreasing

Despite the above issues, a physiological homeward effect may push the party forward with greater efficiency than originally assumed. However, since physical endurance has its limits, one must think that the party could not endlessly increase its performance. This limit is poorly defined and likely depends on many individual factors and the situation.

⋮

Sustained velocity. In the above, I analyzed temporary sledging velocity changes during the Captain Scott *South Pole Journey*. These changes reflected changes in all spatiotemporal variables. Now I am concerned about *sustained* velocity, whose changes may reveal interesting features hardly detectable at the level of daily changes. On Fig. 11.4, I depicted a comparison of daily sledging distances of the First and Second Return Parties, along with the Captain Scott party, for the entire period of sledging time from Nov. 3rd, 1911 through Mar. 12th, 1912. On the same figure, I also depicted a polynomial fit (the nth order polynomial) to the respective data. The purpose of curve fitting is to construct a curve (mathematical function) that has the best fit to the daily sledging velocity of each party. The curves obtained are depicted in Fig. 11.4, together with respective daily velocity data. These polynomial fits show that despite a number of days when all the parties did not move at all (8 times, the daily velocity was 0), during the Barrier stage, including the four days blizzard in December 1911, the sustained sledging velocity was around the assumed daily sledg-

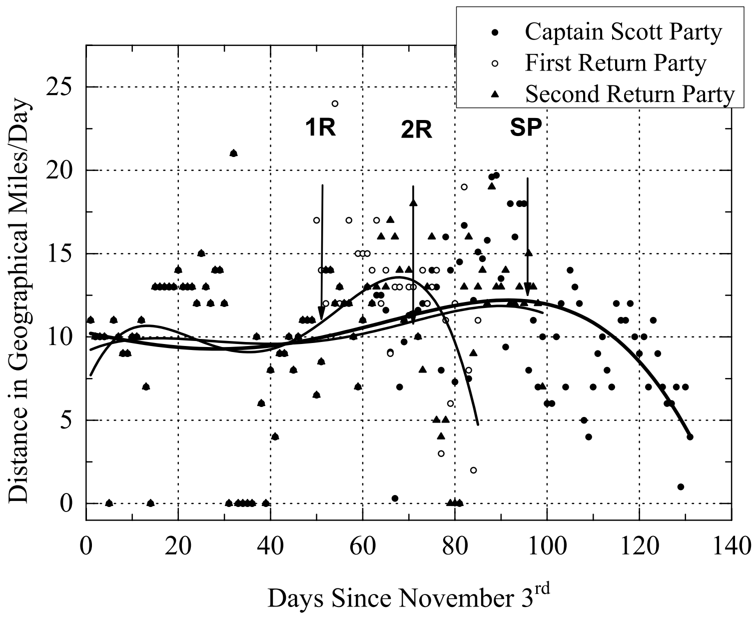


Figure 11.4. Daily sledged distance vs. time expressed in days since Nov. 3rd, 1911. Respective data is depicted for the First Return (**1R**) Party Nov. 3rd, 1911 – Jan. 26th, 1912; the Second Return (**2R**) Party Nov. 3rd, 1911 – Feb. 9th, 1912; and Captain Scott's (**SP**) party between Nov. 3rd and Mar. 12th, 1912, respectively. The polynomial fit to the respective range of data is shown by the solid black lines. The drop arrows indicate the times when given parties started to descend the Beardmore Glacier.

Table 11.3. Meteorological record of Captain Scott's party during the descent of the Beardmore Glacier.[1]

Date and Time		Temperature [°F]	Wind		Weather[3]	Cloud Amount 0–9
Date/1912	Hour		Direction	Force (0–12)[2]		
Feb. 7th	6	–20.3	–	–	–	–
	15[4]	–9.8	–	–	–	–
	21	–11.3	–	4	b.	0
Feb. 8th	6	–13.7	–	–	–	–
	13	–11.5	SSW	6	b.	
	21	–0.5	Calm	0	o.	–
Feb. 9th	6	6.9	–	3	o. c.	9
	15	9.7	–	–	–	–
	21	12.2	Calm	0	–	–
Feb. 10th	6	10.8	Calm	0	–	–
	15:30	12.5	Calm	0	o. f. s.	
	20:30	9.4	N	1–2	o. f. s.	10
Feb. 11th	5:30	0.7	SSW	2	c. f.	9
	15	6.0	SSW	1	o. c.	9
	23	3.0	S	4	b. c.	4
Feb. 12th	5:30	2.3	–	–	b. c.	3
	14:30	11.0	–	–	–	–
	22	6.5	–	–	–	–
Feb. 13th	9:30	6.0	E	1	o. f. s.	10
	14[5]	8.9	SSE	1	o. f. s.	10
	22	9.7	Calm	0	c. b. m.	6
Feb. 14th	6	7.4	Calm	1	b. c.	5
	15	6.6	S	1	b. c.	3
	21:30	0.8	S	4	c. b.	6
Feb. 15th	6	1.9	S	4–5	c. b.	7
	15	10.4	S	3	o. c.	9
	21:30	3.5	N	1–0	o. c.	10
Feb. 16th	6	5.9	Calm	0	o.	8
	15:30	5.6	N	1	o. f. s.	10
	21:30	6.5	N	1	o. f. s.	10

Date and Time		Temperature [°F]	Wind		Weather[3]	Cloud Amount 0–9
Date/1912	Hour		Direction	Force (0–12)[2]		
Feb. 17th	7:15	3.3	NW	1	o. f. s.	10
	16	–	–	–	–	–
Feb. 18th	6[6]	–1	NNW	2	b. c.	5

1 George C. Simpson, *Meteorology*, Vol. III, Tables, Harrison and Sons, Ltd., London, 1923, *cf.* p. 637–638, Table 72: Register of the Main Polar Party, Cape Evans to Pole and Back to 80°S.
2 The wind force is given in the Beaufort scale.
3 The weather is also given in Beaufort notation (code): **b** – cloud cover: 0 to 2 oktas (0–25%), **bc** – cloud cover: 3 to 5 oktas [okta is a unit of measurement used to describe the amount of cloud cover at any given location] (26–74%), **c** – cloud cover: 6 to 8 oktas (75–100%), **o** – a *uniform* thick layer of cloud completely covering the sky (100%), **f** – **fog** (visibility < 1 km), **s** – **snow** (ice crystals, often branched into 'flakes' in 'warmer conditions', temperatures > –5°C, **m** – **mist** (visibility 1–2 km; there are a variety of definitions of mist; the British Met Office also require a relative humidity between 95 and 100%).
4 Upper Glacier Depôt.
5 Mid Glacier Depôt.
6 Lower Glacier Depôt.

ing velocity of 10.1 miles/day. The temporary setbacks indeed led the party to sledge behind the schedule as depicted on Fig. 9.1. However, whenever it was possible, the parties continued sledging at the initially assumed velocities and sustainable velocity remained steady.

Let me look at the sustained velocity of each party after they reached, on their return, the *Beardmore Glacier.*

1R – the First Return Party (Atkinson, Cherry-Garrard, Wright and Keohane). The party returned right after reaching the Antarctic Plateau. Since its parting with the main party, the sustained velocity of 1R was steadily increasing. After all, the party was sledging on an already traversed downhill route. The homeward effect may have also contributed. However, after the party reached the Barrier, one observes that the sustained velocity was steadily decreasing until the party reached Hut Point.

2R – the Second Return Party (Evans, Lashly and Crean). The party parted from the final Captain Scott party on Jan. 4th, 1912. On the 63rd day from departing Hut Point, on Jan. 13th/14th the party approached the Beardmore Glacier and started to descend. This moment is indicated by the black arrow on Fig. 11.4. From this figure, one can readily observe that, like the case of the First Return Party, the Second Return Party while sledging down the glacier was increasing its sustained sledging velocity. One more time I can repeat what was noticed in the case of the First Return Party: that the downhill and homeward effects played a significant role in increasing sustained velocity. For an additional account see subsection 11.1.8.

SP – the Captain Scott party (Scott, Wilson, Oates, Bowers and Evans). The changes of this party's sustained sledging velocity as depicted on Fig. 11.4 are indeed fundamentally different than the previous parties, but not until just before the Captain

Scott party reached the Beardmore Glacier on Feb. 6th/7th, 1912, the 96th/97th day. Until this date the changes of sustained sledging velocity nicely follow the behavior observed for the returning parties. The homeward effect – a systematic sustainable sledging velocity increase – affected the Captain Scott party after reaching the South Pole on the 76th sledging day. This is clearly visible from Fig. 11.4.

However, just before the Captain Scott party started to descend the Beardmore as indicated on Fig. 11.4 by the arrow, its sustained velocity started to diminish day after day. Actually, the Captain Scott party's sustained velocity from the top of Beardmore Glacier was steadily decreasing until the very end of their journey. The investigative reader may readily consult Captain Scott's journal or Dr Simpson's tables in his Volume III for more precise data, and observe that the party while descending crossed the Beardmore about two days faster than on the way up. This observation is in apparent contradiction to the diminishing sustained velocity, but it does show the ease that descending the Beardmore presented in spite of the inexplicable slowdown. However, here I am not concerned with temporary velocity changes, but in sustained sledging velocity trends. These trends are clearly shown on Fig. 11.4, and the Captain Scott party's sledging velocity is decreasing from the beginning of the Beardmore Glacier to the end of their journey, somewhere close to One Ton Depôt in the middle of March 1912. Additionally, the two days faster descent of the Beardmore compared to the ascent resulted from different sustained velocities during the descent and ascent of the glacier.

In the *Message to the Public*, Captain Scott presented an interesting and curious remark

> The Beardmore Glacier is not difficult in fine weather, but on our return we did not get a single completely fine day; this with a sick companion enormously increased our anxieties.

What did he mean by writing the above comment? His party descended from the Beardmore Glacier about two days faster than sledging in the opposite direction. Captain Scott found time to collect geological specimens, and he also found the strength to drag an extra 35 ℔ of these specimens.

Finally, sledging downward was a straightforward task, since all navigational directions between previous camps and depôts were precisely known. Thus, the Captain Scott party could have been blinded (due to snow-white or fog conditions), yet still sledge towards the Barrier. Where does Captain Scott's expectation of "a single completely fine day" come from? Is a "completely fine day" necessary, or important, or needed for crossing the Beardmore?

One more time, I will make reference to the meteorological data of the Captain Scott[17] party while descending the glacier in comparison with the conditions during the First[18] and the Second[19] Return Parties. Just by examining meteorological records of all parties during the descent of the Beardmore Glacier, one can readily notice that while the weather was changing, at no instance did any party encounter the difficult weather which in a recognizable way obscured the sledging down the glacier. The cloudiness of the sky ranged from zero to a fully cloud covered sky. However, *only* in the case of the Captain Scott party did the sustained velocity at the Beardmore Glacier steadily decrease without apparent reason.

The knowledgeable and investigative reader may suggest that since Edgar Evans was incapacitated due to the injury he suffered in a fall into a crevasse on Feb. 4th,

1912, the party could not sledge as fast as possible. However, it is difficult to accept this rationalization. First of all on Fig. 11.4, one can see a steady decrease of sustained sledging velocity since the Beardmore Glacier was reached by the party. Secondly, if Captain Scott was concerned with Edgar Evans' health, then he should not have stopped and spent time collecting geological specimens. Even if the specimens had been collected, Captain Scott should have discarded most of them as not useful, or depôted them at Shambles Camp and recorded their location, then pressed on down the glacier and to Hut Point. For more on this issue, see subsection 11.1.11.

One more time, we see that all logical explanations do not apply to Captain Scott's expedition. Additionally, we can observe that the sustained sledging velocity of the Captain Scott party (and *only* his party) was systematically decreasing since the party started to sledge down from the Beardmore Glacier.

11.1.4. Misuse of the Dog Team

Captain Scott's adventure with sledging dogs was initially tragic (*Discovery Expedition*), then complex and long lasting (*Terra Nova Expedition*). During the *Discovery Expedition* (1901–1904), Captain Scott's use of sledge dogs was a complete failure. Despite Dr Wilson's assurance[20] of the goal of Captain Scott's *Southern Journey* (Nov. 2nd 1902 through Feb. 3rd, 1903) "to get as far south in a straight line on the Barrier ice as we can, reach the Pole if possible, or find some new land," the party (Captain Scott, Dr Wilson, Lt Shackleton) zigzagged over the Barrier rather than pressing straight South. It clearly resulted from: (1) lack of sledge dog driving skills, (2) lack of skiing skills of being able to ski along the sledge at dog trotting velocity and (3) underfeeding dogs with ½ of required rations (see Tab. 10.6).

Here, however, I am concerned with the *Terra Nova Expedition*. At first, it is not properly understood in what context one is interested in considering Captain Scott's usage or non-usage of dogs. In *general* terms, Captain Scott did not use dogs for his *South Pole Journey*. The dogs were playing *only* a supporting role, and at the last instance (February – March 1912) were ready, contrary to explorers sitting idle at Cape Evans, to fight for Captain Scott's party.

For the reason of different sledging techniques, it is entirely inappropriate and useless to compare Captain Scott's and Captain Amundsen's South Pole journeys. These two bold expeditions were *fundamentally* different missions and weighing them against each other is a pointless exercise, unless one is attempting to diminish or ridicule one expedition or another. Say, for the purpose of selling business leadership books.

Those who wanted to weaken Captain Scott's achievements laughed at his transportation methods by not primarily using sledging dogs. Those who wanted to set "the record straight" appealed to the utilitarian use of dogs by Captain Amundsen and ridiculed it, citing his non-existent uncivilized behavior. However, neither side is appealing from sensible grounds.

The opportunistic, and indeed useless, emotions were readily expressed and endlessly dragged up by various authors, without the benefit of understanding Captain Scott's and Captain Amundsen's expeditions. If one sets a reference for consideration as a South Pole race, then a certain "racing" picture emerges. However, the events in Antarctica in 1911–1912 were not a race. The obvious and not too subtle difference

between race and journey towards a goal must be analyzed and applied to the case under consideration.

To anyone, a race means "a contest or rivalry involving progress toward a goal". However, there are additional ingredients in the meaning of a race. It is the fact that the competitors, at an arbitrary time before the race commences, have a right to prepare to its actual timing as defined by the principle of "Ready, Steady, Go!" The question of who will arrive at the South Pole first was knowable, and only unpredictable events could change it. This knowledge was coming from the north, from many Arctic expeditions. However, even this knowledge was not definitive.

Lt Shackleton's judgment, developed during his *Farthest South Journey*, was that ponies could not ascend the Beardmore Glacier. Without *post factum* insight, Captain Scott's own use of ponies until the foot of Beardmore Glacier and later man-hauling was the right decision, but not trying to use dogs beyond that point was the wrong decision.

Captain Amundsen's decision to use dogs was made under his *assumption* that he would be able to use dogs all the way to the South Pole. Captain Amundsen, similar to Captain Scott, placed and stuffed his depôts according to a 90-days sledging plan. If, for a surface related reason, he could not use the dogs, was he carrying harnesses to continue with man-hauling? To my knowledge, he did not. It was a big gamble by Captain Amundsen. It shows that despite the widely accepted notion that Captain Amundsen was taking robust contingency measures, he was walking a *very* thin line. However, Captain Amundsen's plan from the beginning was very different than Captain Scott's. Captain Amundsen was clear about his methods and aim[21]

> The distance we had before us, from this spot to the Pole and back, was 683 miles. Reckoning with the ascent that we saw before us, with other unforeseen obstructions, and finally with the certain factor that the strength of our dogs would be gradually reduced to a fraction of what it now was, we decided to take provisions and equipment for sixty days on the sledges, and to leave the remaining supplies – enough for thirty days – and outfit in depot. We calculated, from the experience we had had, that we ought to be able to reach this point again with twelve dogs left. We now had forty-two dogs. Our plan was to take all the forty-two up to the plateau; there twenty-four of them were to be slaughtered, and the journey continued with three sledges and eighteen dogs. Of these last eighteen, it would be necessary, in our opinion, to slaughter six in order to bring the other twelve back to this point. As the number of dogs grew less, the sledges would become lighter and lighter, and when the time came for reducing their number to twelve, we should only have two sledges left. This time again our calculations came out approximately right; it was only in reckoning the number of days that we made a little mistake – we took eight days less than the time allowed. The number of dogs agreed exactly; we reached this point again with twelve.

Indeed, Captain Amundsen's arrangement was fundamentally different from Captain Scott's organization. Despite that, both expeditions reached their goal but at different times and with different physical effort. An interesting comparison of both

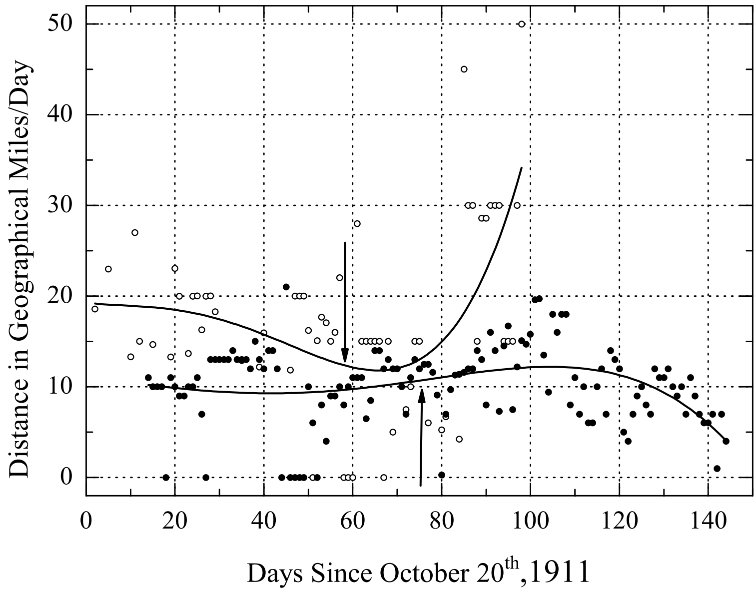


Figure 11.5. Comparison of daily sledged distances of Captain Amundsen's party (○) and Captain Scott's party (•) and respective sustained velocities (——) and (——). The solid arrows indicate the date when the South Pole was reached.

expeditions is depicted on Fig. 11.5, where sustained sledging velocity is presented. In the previous subsection, I already discussed detailed features of daily sledging distances of the Captain Scott party, and the reader is asked to consult these remarks. However, here let us look at Captain Amundsen's sledging record, which is equally interesting and telling.

Captain Amundsen's sustainable daily velocity was gradually, right from the start, slightly decreasing day by day, well until the party was returning from the Pole. It is an interesting feature, and shows that Captain Amundsen understood that sledging at the Antarctic Plateau is physically more demanding than over the Barrier, due to its height. However, right after *all* possible obstacles had stopped playing a role or threatening his party, the homeward effect is clearly visible. This shows that for a good time, Captain Amundsen's team sledged well under its initially assumed sledging velocity. It also confirms the very different character of Captain Amundsen's journey, as compared to Captain Scott's continuous struggle to drag the sledges. Captain Amundsen's return leg over the Barrier looks very much different than Captain Scott's respective systematic decrease of daily distances sledged. Indeed, it is perplexing to observe Captain Amundsen's "joy of returning home" as opposed to Captain Scott's and the Second Return Party's desperate struggle for life. Unless it was not the case for the Captain Scott party. As we shall see, they did not struggle for life – they strived for posthumous fame, remembrance and recognition.

But all the above resulted from the initial plans undertaken well before departing to Antarctica. Of course, Captain Scott was also making such plans and respective provisions. Before the departure to Antarctica as I have mentioned on a number

of occasions, Captain Scott in 1910 presented a lecture at the Royal Geographical Society and briefly outlined his final plans. In regard to his *South Pole Journey*, he explained[22]

> I may pause here to give my opinion on the conditions and prospects of the southern journey. We know now that the first phase of that journey must be over the plateau of the Great Barrier, the second a climb through mountain passes, and the third a transverse of a lofty inland plain. It is only possible, certainly not probable, that any means of transport can be taken beyond the first phase. If it is impossible, then we shall have, as had Sir Ernest Shackleton, to make all further advance with the unaided efforts of men alone. Shackleton's party started on the second phase with full loads, and achieved what is probably the maximum that could be accomplished under such circumstances. The only manner in which such a record could be beaten is by taking a larger party of men and sending sections of them back at intervals. This is, of course, a well-known expedient in polar work, but it has to be remembered that each multiple of the original number of men only adds a fraction, and a diminishing fraction, to the radius of equal numbers can only hope to achieve a distance one-third greater than it would have done had it been without a supporting party. Taking this fact into consideration, together with the increased risk of individual breakdowns which the larger number of men must bring, it must be evident that the achievement of the South Pole, in view of the distance which has to be traversed in the second and third phases of the journey, is by no means a certainty. Of course one is not without hope that either the ponies, the dogs, or the motor sledges, may traverse the disturbed regions of the glacier, and if this is possible the difficulty of the journey should be greatly diminished.

This long but concise description is indeed self-explanatory. One can see that Captain Scott kept his options open as far as the use of draught animals; ponies and dogs. In relation to dogs, the only question was how Captain Scott imagined to drive them. The "Russian" style, or Captain Amundsen's style? Since for both styles, the certain and extensive practice was needed, and in the case of the Captain Amundsen style's requirement for proficiency in skiing, it appears that neither style was under serious consideration by Captain Scott. On Feb. 22nd, 1911 he only commented[23]

> Meares is excellent to a point, but ignorant of the conditions here. One thing is certain, the dogs will never continue to drag heavy loads with men sitting on the sledges; we must all learn to run with the teams and the Russian custom must be dropped.

However, in an unknown later moment of time, Captain Scott not only dropped the Russian style, but also serious skiing skills were not developed through training. It appears that the only Norwegian member of Captain Scott expedition, Tryggve Gran, was capable for sustained skiing with a sustained trotting velocity of the sledge dogs.[24] However, only Meares and Dmitrii were capable of sledge dog driving in the Russian style.

In Chapter 10, I analyzed the actions of Cecil Meares, Dr Simpson, Dr Atkinson, and Cherry-Garrard in relation to Captain Scott's orders and subsequent fictitious

relief actions. Inevitable elements of these actions were the dogs and the obvious lack of dog-driving skills by Dr Atkinson and Cherry-Garrard.

These were obviously cases of Captain Scott's negligence in not making (or selecting) his personnel to be versatile in many different polar skills, like skiing and dog-driving. Despite that, it is evident, however, that the lack of these skills in no way contributed to the Captain Scott disaster. More importantly, one has to remember that Captain Scott's *South Pole Journey* in the event was largely dog-independent, especially its last leg over the Barrier. The investigative reader may recall that on Mar. 10th Captain Scott commented, "The dogs which would have been our salvation have evidently failed.* Meares had a bad trip home I suppose." However, from section 10.3, we know that Meares did not fail but mutinied and escaped with Dr Simpson from Antarctica. Thus, meeting Captain Scott's party did not depend on the use or misuse of dogs but *depended on people*, who turned their backs on Captain Scott and his party in different acts of tacit mutiny at Cape Evans/Hut Point.

In relation to dog usage during the final sledging days at the Barrier, Roland Huntford presented his usual unjustified and unfounded critical account of Captain Scott's actions[25]

> Scott blandly said that "the dogs should get back quite easily; there is food all along the line." This was all the thanks that Meares got for his effort. Scott was like an officer on some hair-raising mission, taking self-sacrifice in his subordinates for granted. He had done little to help Meares on his way.
>
> As it was, Meares had a hard run back. By going on longer than originally intended, he had stretched his rations to the limit. He had to go short. This angered him because he felt his life had been unnecessarily risked, and he bore a lasting grudge.

Indeed, Huntford's description borders on fiction and storytelling. All of the above is entirely unfounded. Should Captain Scott say thank you all the way for their efforts? Even if I assume that Captain Scott was not in a verbal way thanking his comrades, he was appreciating his "subordinates" by managing their Antarctica affairs from the beginning. The case of Meares and Captain Scott taking dogs "further than intended" may be a noteworthy example if one makes an educated analysis. Let me recall that Captain Scott had a plan, a 144-days sledging schedule, and according to this plan the depôts (Shambles Camp, Lower, Middle and Upper Barrier Depôts, One Ton Depôt) had been stuffed with food and fuel rations for all returning parties. Consequently Captain Scott assumed that the parties were sledging according to the 144-days schedule, and with a minimum sustained velocity of 10.1 miles/day. Sledging at a steady high velocity meant, as I have discussed on a number of occasions, a higher frequency of arriving at depôts and thus a surplus of food and fuel available to the returning party.

At the time of Meares parting from the Captain Scott party, it was known that the dog party would easily sledge with velocities higher than the man-hauling velocity of 10.1 miles/day. Therefore, the party would arrive at depôts more frequently than in the assumed 144-days plan. While on the Beardmore Glacier, Cherry-Garrard accounted in his diary[26]

> For the first week up the glacier [Beardmore – KS] we are to go one biscuit short to provision Meares on the way back. The motors depôted too much

> and Meares has been brought on far farther than his orders were originally bringing him. Originally he was to be back at Hut Point on December 10. The dogs, however, are getting all the horse that is good for them, and are very fit. He has to average 24 miles a day going back. Michael is well out of this: we are now eating him. He was in excellent condition and tastes very good, though tough.

This is almost exactly what happened. Cecil Meares' dog-sledging velocity is depicted on Fig. 10.1. It is evident from this figure that during Meares' return he was sledging with an average velocity of 14.5 miles/day. It is about 44% faster than the minimum expected man-hauling velocity. However, Meares' return was not as fast as Cherry-Garrard and – I presume Captain Scott – assumed. According to Captain Scott's possible presumed expectations of the return velocity of Meares' party (24 miles/day), he was expected to arrive at Hut Point on Dec. 26th, 1911. Instead, as I discussed in more detail in section 10.2 he arrived on Jan. 4th, 1912.

In the meantime, Dr Simpson at Cape Evans, though as per Captain Scott's orders (see subsection 10.8.2), mindlessly dispatched Day's party (Nelson, Clissold, Day, Hooper) on Dec. 26th, 1911 to re-supply One Ton Depôt with *only* 3 X.S. food/fuel units.

Let me bring to the reader's attention Cherry-Garrard's smokescreen over the issue of not transferring 5 X.S. units to One Ton Depôt as requested by Captain Scott[27]

> The weights of the man-hauling party [Day's – KS] did not allow for the transport of the remaining two XS rations, nor for any of the dog-food.

Cherry-Garrard wanted to set a prelude for his own reasons for sitting idle at One Ton Depôt while on his First Relief Party journey. However, this is just Cherry-Garrard's self-justifying "explanation". Yet again, I discussed all pertinent issues in Chapter 10.

A smokescreen similar to Cherry-Garrard's was also presented in a more elaborate way by Karen May and Sarah Airriess, who while looking at "food/equipment numbers" arrived at this conclusion[28]

> The maximum load for a man-hauling party, based on others' experiences (Evans 1949: 198) [*sic*], was about 185 pounds per man, so four men should pull around 740 pounds. The weight of the food and equipment necessary for four weeks puts the starting weight at 517–578 lbs. Three X.S. units, Scott's bare minimum for the 'vital' resupply, total just over 180 lbs. Added to the base weight [non-consumable items – KS], this brings the total to 697–758 lbs, around the maximum, leaving little or no room for dog food. This would not have been disobedience of Scott's contingency orders for the man-hauling team: these orders make no mention of dog food, but only that three X.S. rations must be brought.

This conclusion is entirely uneducated, false, dishonest, and proves nothing except the authors' false assumptions. It is an argument from false premises. These false premises are:

1. Captain Scott's orders and subsequent action were error free,
2. Captain Scott's orders were inviolable even if later developments demonstrated the need for vital changes,

3. The self-sustained sledging efficiency was higher than assumed,
4. The returning parties were sledging according to the 144-days schedule,
5. While in command at Cape Evans, Dr Simpson never bothered with "*what if*" analyses and contingency actions,
6. False citation of Captain Evans for their claim that 740 ℔ was the maximum sustainable load for a four-man man-hauling party.

Before Cherry-Garrard delivered 2 X.S. in early March 1912, One Ton Depôt contained 3 X.S., which were sufficient for two four-man returning parties to sledge back to Hut Point if they were ahead of the 144-days schedule. Thanks to this being true, these 3 X.S. were sufficient and used by the First and Second Return Parties. *If* for an entirely unspecified reason Captain Scott turned back before reaching the Pole, or *if* for the same reason his party was sledging at much higher velocities than assumed (relative to the 144-days plan), then Captain Scott's party would perish due to lack of food/fuel at One Ton Depôt. If Captain Scott's party returned to One Ton Depôt between say Feb. 9th and Mar. 1st, 1912, the party most probably would starve to death.

Apparently, May and Airriess derived their sledging data from Cherry-Garrard, Dr Wilson, Dr Taylor, and Captain Evans. However, why did they derive their data from these sources if the required data were not only not theoretical, but practically available from Captain Scott's sledging journal? Namely, one should recall that at the foot of the Beardmore Glacier, Captain Scott set his three parties into a *self-sustained* sledging course. Each party carried base weight and food/fuel rations. Altogether +21 X.S. rations for the upcoming sledging work. These figures in the most representative way define the *lower* bound of self-sustained sledging efficiency of Captain Scott's parties, as well as say Day's party. Day's four-man party was able to *self-sustained* sledge for about 8 weeks, which translated in terms of the 144-days plan to about 566 miles.

Since the round distance from Hut Point to One Ton Depôt was 2×118 miles = 236 miles, the party of four men would need 24 days of sledging, which is equivalent to about 3½ X.S. for self-consumption. Thus, Day's party could take 8 – 3½ = 4½ X.S. instead of 3 X.S. That is under the assumption of a 10.1 miles/day sledging velocity. However by increasing sledging velocity to say 13.2 miles/day, Day's party would need 18 days and could carry 5½ X.S. to be depôted at One Ton Depôt. Alternatively, Day's party could relay and/or be supported at least to Corner Camp by an additional party of two. None of that happened, and Day's party sledged at a *leisure velocity* of about 8.7 miles/day (Dec. 26th through Jan. 21st). One would suggest that the weather during the Days' Party's journey was prohibiting sledging with higher velocities. However, even a cursory examination of the party weather record does not support this notion. On the contrary – see Fig. 11.6 – the party was sledging in the middle of Antarctica's summer in splendid weather, mild temperatures and winds.

In the meantime at Cape Evans, Dr Simpson was sitting idle and not bothering with contingency plans to counter flaws in Captain Scott's orders. Instead, he was busy with figuring his own contingency of his mutiny, from the *command post* that Captain Scott's orders had posted him to at Cape Evans.

I would not be historically accurate if at this moment I did not mention one particular entry from Dr Simpson's diary, cited by May and Airriess, in which he hypocritically on Jan. 21st, 1912 makes reference how much he was caring about Captain Scott and his party[29]

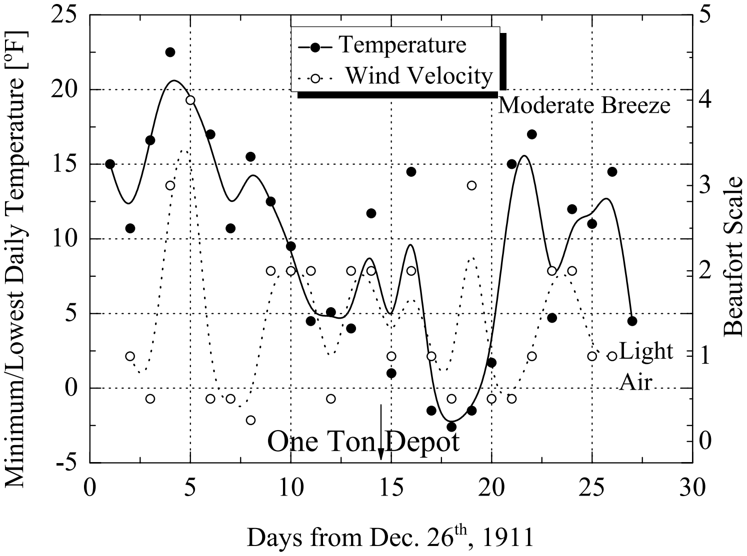


Figure 11.6. Day's party meteorological data: daily minimum/lowest recorded near surface temperatures and wind velocity expressed in Beaufort scale during the party's journey from Hut Point to One Ton Depôt and back, Dec. 26th, 1911 through Jan. 21st, 1912.

> Meares intended to go out to One Ton Camp again taking a little [*sic*] more food, but chiefly [*sic*] to take out a stock of luxuries like Irish Stew, Marmalade and Tinned Fruits … On the 17th of January Meares had his sledges packed with the idea of starting that evening.

I admit, I get shivers while reading Dr Simpson. If luxuries were "a little more food," why then did Day's party not take them? But chiefly, was Captain Scott in want of Irish Stew or Marmalade? I wonder at which moment of time Dr Simpson decided that Captain Scott and his party will not eat Irish Stew cooked by Dr Simpson and delivered by Meares.

What is telling is May and Airriess' false citation of Captain Evans. They state "The maximum load for a man-hauling party, based on others' experiences (Evans 1949: 198), was about 185 pounds per man, so four men should pull around 740 pounds," but a check of Captain Evans' book reveals the truth[30]

> Arrived at this important depot we deposited the dog pemmican and took on three sacks of oats, but after proceeding under motor power for 1½ miles, the big end brass of No. 1 cylinder went, so we discarded the car and slogged on foot with a six weeks' food supply for one 4-man unit. Our actual weights were 185 ℔. per man. We got the whole 740 ℔. on to the 10 ft. sledge, but with a head wind it was rather a heavy load. We kept going at a mile an hour pace until 8 p.m.

Captain Evans clearly indicated that 740 ℔ for a four man party was only "rather a heavy load" when a head wind impeded progress, and otherwise was nothing special. He also indicated that this weight was for 6 X.S. rations + non-consumables

("… six weeks' food supply for one 4-man unit …"). It is apparent that the esteemed peer-reviewed journal of the Scott Polar Research Institute, *Polar Record*, let an easily detected false citation of Captain Evans past peer review and into publication.

To finish this subsection, let me comment on the central issue of how the misuse of the dogs during the *Southern Journey* came into the picture. From the above analysis, as well as analysis presented in Chapter 10, it is evident that there was no serious mismanagement of the dogs.

Firstly, Captain Scott, well before departure, issued written orders to Meares (subsection 10.8.1) and to Dr Simpson (subsection 10.8.2) and described his plan and possible alternations and subsequent actions. While on the move, Captain Scott issued a written order (carried by returning Day and Hooper) to Dr Simpson[31]

> My dear Simpson. This goes with Day and Hooper now returning. We are making fair progress and the ponies doing fairly well. I hope we shall get through to the glacier without difficulty, but to make sure I am carrying the dog teams further than I intended at first – the teams may be late in returning, unfit for further work or non-existent. So don't forget that the [supplies] must be got to One Ton Camp, Lat 79½ somehow.

One must observe that taking the dog team further than originally envisioned resulted from Captain Scott's contingency of ensuring that his parties would sledge efficiently up the Beardmore Glacier. It is certainly possible that Captain Scott's decision resulted in the dogs encountering on their return journey the snow conditions right after the 4-days blizzard in December 1911. Since the provisions were exactly counted according to the 144-day schedule, Captain Scott was gambling on the issue of finding an effective solution between the length of distance (time) at which Meares was supporting the Captain Scott parties, Meares' safe return, and the parties food/fuel rations.

Secondly, despite taking Meares and Dmitrii and making an extra 2×142 miles, Captain Scott ensured there was a safe return as well as ensuring appropriate action would be taken at Cape Evans by Dr Simpson. A safe return by Meares was based on the right assumption of his increased dog-sledging velocity and food rations (biscuits). How they dealt with fuel for the Meares party is entirely unknown.

From the above account, the misuse of the dog team does not emerge. In fact, they were well managed, provided that one understands that anyone participating in this adventure was ready for hardships of all sorts.

A perplexing question arises: since almost every author was making a reference to Captain Scott's misuse of the dog team (Meares), how and by whom was the question raised? It appears that it was Roland Huntford's fabrication, who without a shred of historical evidence proclaimed[32]

> Evans also carried a message from Scott changing the orders for the dogs yet again … Meares now was to come out and meet Scott between 82° and 83°S., some time towards the middle of February. The ostensible purpose was to hurry him back in time to catch the ship … It was in any case a vital alteration to his plans. It was verbal [*sic*]. It bore the stamp … of last-minute improvisation. Scott assumed that Evans would deliver it in time.

Since Huntford in his book is not referencing anything, it is entirely pointless to discuss his historical account, and his work should be understood as a work of fiction.

The example above shows where he fabricated a "verbal" message from Captain Scott. It is not only "verbal," but also an *untraceable* observation in any Captain Scott or any other explorer's account, including Captain Evans' historical documents which he published in *South with Scott*.

Re-calling Captain Scott's written orders to Meares (Oct. 20th, 1911) and Dr Simpson (subsection 10.8.1 and 10.8.2, respectively), one can readily observe that[33]

> About the first week of February I should like you to start your third journey to the South … you should aim at meeting the returning party about March 1 in Latitude 82 or 82.30

Therefore, it was not "last-minute improvisation" but careful planning by Captain Scott. Sadly, the issue of verbal last-minute orders to Meares, fabricated by Huntford has propagated into the main accounts of Captain Scott's *Terra Nova Expedition* and started a life of its own in the accounts of (ironically) Sir Ranulph[34], Crane[35], Preston[36], Dr Barczewski[37], Dr Solomon[38], Wheeler[39], Smith[40] and Lagerbom[41]. For the reader's convenience and insight into how Huntford's sheer fabrication was picked up and evolved on its own to be included in many authors accounts, please refer to the Appendix for this subsection.

To conclude the fabricated issue of the misuse of the dog team by Captain Scott, let me bring to the reader's attention one more example of related manipulations by Dr Solomon. It appears that out of all the authors mentioned above, only Dr Solomon was fully aware of Captain Scott's *written* orders as presented by Lt Evans in his book 'South with Scott'. However, Dr Solomon could not possibly have arrived at her deductions. Dr Solomon's inferences from Captain Scott's orders could not strike anyone involved in the actual events.

Firstly, Dr Solomon is diminishing the evident (fundamental) importance of Captain Scott's *instructions* to various members of his expedition by calling them *letters*. Captain Scott himself titled these documents, for example, "II.--INSTRUCTIONS TO DR G. C. SIMPSON." The meaning of words *Instructions* and *Letters* is significantly different. These Captain Scott *Instructions* were written in a "soft" manner; however, no one would have had the slightest doubt or query that these *Instructions* were simply orders to be followed by personnel to whom they were issued. It is indeed an intriguing question as to why Captain Evans published Captain Scott's orders in his book. Perhaps he was quietly angry at the mutiny that had taken place around him as he was an invalid, and wished to leave investigative future readers a clue hidden in plain sight?

Secondly, Dr Solomon, by messing with her account of Captain Scott's instructions, takes away clear responsibilities from the people to whom these instructions were issued, in particular, Cecil Meares and Dr Simpson. From Chapter 10 and sections 10.1 and 10.2, we know that these two, Meares and Dr Simpson, were key in Captain Scott's plan reassured by his written instructions/orders. Despite that, Dr Solomon concluded[42]

> Scott's letter to the captain of the *Terra Nova* noted that Meares might leave Antarctica with the vessel, depending upon letters from home.[30] [Evans, *South with Scott*, pp. 187–88, 172–74, 178][43] In this case the responsibility [*sic*] for the third dog journey must fall to someone else, an individual not specified [*sic*].

However, the investigative reader may easily consult Captain Scott's orders to the Commanding Officer of the *Terra Nova* and find[44]

> In regard to the constitution of the wintering party for the second winter, much must remain in doubt. The following members will return in any case: 1. Taylor, whose leave of absence transpires. 2. Ponting, who will have completed his work. 3. Anton, who has had enough of it.
> *Anton* took the dark season very badly; it preyed on his superstitions, but he has worked like a Trojan and is an excellent little man. Please recommend him highly if he wants to get work in New Zealand.
> *Meares* may possibly return; it depends on letters from home.
> The following are certain to stay [*sic*]: Bowers, Simpson, Debenham, Wright, Nelson, Atkinson, Clissold, Hooper, Dimitri [Dmitrii].
> The movements of the following depend (i) on the date of the return from the South; (ii) on the fresh transport which you have brought: Myself, Wilson, Evans, Oates, Cherry-Garrard, Gran, Day, and the seamen.

It is *evident* that Captain Scott expected that Dr Simpson would *stay* at Cape Evans. Additional evidence comes from the line in Captain Scott's order/instruction to Dr Simpson, which reads "MY DEAR SIMPSON [*sic*],-In leaving you in charge of the Cape Evans Station …". Thus, Captain Scott in a *written* and *explicit* way specified who was in charge at Cape Evans while he was away on his sledging journey to the South Pole. It was Dr Simpson, or "my dear Simpson" as Captain Scott officially addressed him, or "old maidish" as Captain Scott called him privately, who was in charge at Cape Evans.[45] Thus, Dr Simpson was directly responsible for all actions at Cape Evans. However, instead of fighting for Captain Scott's returning party, as I carefully accounted in Chapter 10, Dr Simpson mutinied and escaped from Antarctica. Dr Simpson was evidently aware of Captain Scott's orders, contrary to the fallacious account and testimony by Dr Solomon.

In summary, it is evident that the issue of the "misuse of the dog team" by Captain Scott and his alleged orders resulted from Roland Huntford's fabrication of "verbal" orders given to Lt Evans upon his parting with the main South Pole party. The logistics of all participants in the South Pole attempt was predetermined in Captain Scott's plan with specific orders/instructions, which were outlined well before Nov. 3rd, 1912, and updated by Captain Scott on Nov. 24th, 1911, in the form of a note carried and delivered to Dr Simpson by the returning Day and Hooper party (see section 10.1). The actual events obliged Captain Scott to make certain plan modifications (alternations). However, if every member of the expedition was following his instructions/orders, the whole logistic chain of action was sufficient, and thoroughly envisioned and updated (without the fabricated by Huntford verbal orders), by Captain Scott. The *only* loose element in Captain Scott's scheme was, as it usually is, human individual actions. No one could infer prior to the expedition that Dr Simpson and Meares would call for mutiny under a *tacit concession* (*acquiescence*) of all explorers present at Cape Evans. No one could infer that after Dr Simpson's and Meares' mutiny, Dr Atkinson and Cherry-Garrard would launch phony relief journeys. Also, no one could take for granted that Roland Huntford's fabrication would take on a life of its own and continue into the testimonies of all authors describing the *Terra Nova Expedition*. Fortunately for all of them, Captain Scott perished. He never got the chance to address pertinent and

inconvenient "why" questions for his "dear" comrade Dr Simpson, who washed his hands of the affair, who did not care for Captain Scott's orders and consequently the lives of Captain Scott and his party.

Appendix to subsection 11.1.4
The purpose of this appendix is to enumerate the mutations of Roland Huntford's original fabrication of verbal orders given to Lt Evans just before his departure from the Captain Scott team on the Antarctic Plateau. Let me start with a quotation of Huntford's account, and then continue with related quotations ordered by the date of publication.

Roland Huntford (1986)

> Evans also carried a message from Scott changing the orders for the dogs yet again … Meares now was to come out and meet Scott between 82° and 83°S., some time towards the middle of February. The ostensible purpose was to hurry him back in time to catch the ship … It was in any case a vital alteration to his plans. It was verbal [*sic*]. It bore the stamp … of last-minute improvisation. Scott assumed that Evans would deliver it in time.

Diana Preston (1997)

> Evans was also carrying an oral message which would play its part in the disaster ahead. Scott had changed his instructions yet again for the dogs. Meares was to bring the teams out to meet the returning party between 82° and 83°S towards the middle of February, to enable the returning Polar Party to be in time for the Terra Nova … Scott's great mistake was to assume that Evans would deliver the message in time.

Charles Lagerbom (1999)

> A final word from Scott to Evans once more changed the plans for the dogs. Evans carried with him the message from Scott that the dogs were to greet the returning polar party between 82° and 83° South latitude, much farther than had earlier been determined.

Sarah Wheeler (2001)

> Evans had more verbal orders from Scott about the dogs: they were to come further south to meet him on his way back, and hurry him back to Cape Evans before the ship left. These orders were forgotten in the ensuing drama.

Susan Solomon (2001)

> Scott's letter to the captain of the *Terra Nova* noted that Meares might leave Antarctica with the vessel, depending upon letters from home.[30] [Evans, *South with Scott*, pp. 187–88, 172–74, 178][46] In this case the responsibility [*sic*] for the third dog journey must fall to someone else, an individual not specified [*sic*].

Ranulph Fiennes (2003)

> Scott gave various messages to Teddy Evans to take back to Cape Evans. One, for Meares, updated his previous three instructions on what he wanted

> the dog teams to do. This last order cancelled the previous ones: Meares was to come out and meet Scott between 82°and 83°on the Barrier at some time towards the middle of February.

David Crane (2005)

> On 4 January … he had given Teddy Evans the last of a series of instructions taken back by the returning parties, ordering that the dogs should be brought out to meet him somewhere between 82° and 83°S.

Stephanie Barczewski (2007)

> With Evans, Scott sent back an amendment to his previous order, giving more precise instructions to Meares to bring the dog teams out to between 82 and 83° in mid-February to meet the returning polar party.[75]
> [Reference 75 in Barczewski book reads] By the time he returned to Cape Evans, Evans was half-dead from scurvy and neglected to relay Scott's revision of his order regarding the dogs to Atkinson.

Roland Huntford (2010)

> Likewise, Scott had only himself to blame for the absence of the dogs that would have been his salvation. Meares did have a 'bad trip home' because Scott had taken him further than intended. This was the last straw, and Meares went home in *Terra Nova*, which had come and gone, disgusted with the whole affair. That left a gap in the chain of command, with Dmitrii the only dog driver, unable to work on his own.
>
> Again, Scott was suffering from unclear orders of his own. He had left confused and contradictory instructions for the dogs, repeatedly changed along the way. A critical last-minute order to bring them between 82° and 83°S to help him home head been in transmission. He had mentioned it to Lt Evans before parting at the head of the Beardmore Glacier. Evans had fallen victim to scurvy on the way back, and in the ensuing race for life, understandably forgot what Scott had said. Besides, a depot of dog food Scott mentioned in one of his messages did not in fact exist. So the dogs waited at McMurdo Sound, their masters uncertain what to do, unwittingly leaving Scott and his companions to their fate. Eventually Cherry-Garrard and Dmitrii made a half-hearted attempt with the dogs to meet the polar party, but got no further than One Ton Depot, where they waited in vain before turning back.

11.1.5. Navigation and Navigation Methods

Captain Scott's journal entry on, for example, Jan. 15th, 1912 tells us a lot about his navigation and navigation methods

> Camp 67. Lunch obs.: Lat. 89°26′57″; Lat. dead reckoning, 89°33′15″S.; Long. 160°56′45″ E.; Var. 179 E.

In section 2.3, in relation to Cherry-Garrard's non-believable inability to learn elementary compass navigation, I briefly discussed Captain Scott's stand on learning

navigational skills by fellow explorers. In order to argue for Captain Scott taking all necessary measures to ensure right navigation skills and methods, let me quote from his journal on June 12th, 1911

1. Every officer who takes part in the Southern Journey ought to have in his memory the approximate variation of the compass at various stages of the journey and to know how to apply it to obtain a true course from the compass. The variation changes very slowly so that no great effort of memory is required.
2. He ought to know what the true course is to reach one depot from another.
3. He should be able to take an observation with the theodolite.
4. He should be able to work out a meridian altitude observation.
5. He could advantageously add to his knowledge the ability to work out a longitude observation or an ex-meridian altitude.
6. He should know how to read the sledgemeter.
7. He should note and remember the error of the watch he carries and the rate which is ascertained for it from time to time.
8. He should assist the surveyor by noting the coincidences of objects, the opening out of valleys, the observation of new peaks, &c.[19] [19 stands here for the editor's note in Captain Scott's printed journal – KS][47]

One cannot do better than that. To my knowledge, only Cherry-Garrard, as described in section 2.3, could not learn the navigational skills requested by Captain Scott. Therefore, Huntford presented the far-fetched and unsupported comment that[48]

> To all intents and purposes, Wilson could not navigate; neither could Oates or P.O. Evans, and Scott himself was out of practise. Competent astronomical navigation [*sic*] was vital in travelling over the featureless interior of the polar plateau, not to mention finding the goal of the journey. No navigator, no pole, about sums it up. (Amundsen had *four* qualified navigators on his Polar party)

As usual, Huntford presents unsupported notions. No shred of evidence about Captain Oates' navigational skills is available. Therefore, as per Captain Scott's instructions above, one must assume otherwise. Additionally, the investigative reader must observe that the only celestial body for Huntford's "competent astronomical navigation" was the Sun, which is visible at the Antarctic Plateau for 24h or close to it during the Antarctica summer. Therefore, the theodolite observations of the Sun were sufficient. These observations were needed for *precise* measurement of the party's location. However, for all practical sledging purposes, Captain Scott's request laid out in point 1, combined with dead reckoning, was more than satisfactory. More importantly, it was useful even in whiteout blizzard conditions. By looking at the compass needle and recalling magnetic declination (a slowly varying variable), one could follow the expected (assumed) track.

On Fig. 2.5, in conjunction with Cherry-Garrard's non-believable inability to sledge according to a compass needle, the magnetic declination changes between Hut Point and Beardmore Glacier were presented. The changes of declination on a grander scale from Hut Point to the South Pole are depicted on Fig. 11.7.

From this figure, one can readily see that the magnetic declination between Hut Point and the South Pole is changing slowly, and a fixed rate of change can be ef-

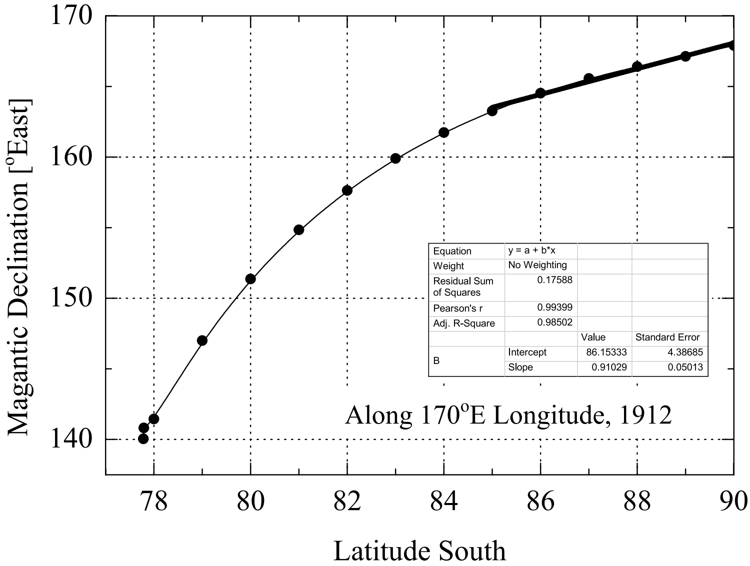


Figure 11.7. Magnetic declination calculated using NOAA's calculator[1] (variation) along longitude 170°E, the approximate route of the Captain Scott party. Depicted changes of magnetic declination (variation) are clearly a nonlinear function of location along latitude. Nevertheless at distances of ½° or even better ¼° (15 miles), fairly linear and simple compass readings were sufficient to guide the explorers. The thick solid line is a linear function of magnetic declination [degrees E] = 86.15 + 0.91 × latitude [degrees S] between 85°S through 90°S along 170°E longitude.

1 See for example http://www.ngdc.noaa.gov/geomag-web/

fectively used to mark the desired sledging direction. Magnetic variation over the Antarctic Plateau (from 85°S) can be well approximated by a linear function (see Fig. 11.7) in the form: magnetic declination [degrees E.] = 86.15 + 0.91 × latitude [degrees S.]. Combined with dead reckoning observations as a checking measure, one can easily sledge toward the Pole.

Captain Scott used this strategy, but in a more ingenious way which almost seventy years later was developed in a wider context by the American statistician Bradley Efron.[49] The method is called the bootstrap re-sampling technique, and in its simplest form can be described as it was done by Captain Scott.

Captain Scott was sledging toward the South Pole in the footsteps of Lt Shackleton's journey of Oct. 29th, 1908 through Feb. 28th, 1909. Obviously, Lt Shackleton had to navigate somehow, and one may rightly say that he charted most of the route. His charted geographical data was known to Captain Scott and the public in the second volume of his book about the *Nimrod Expedition*. Lt Shackleton charted the South Pole route by giving 11 reference points, which included noon latitude and magnetic variation (declination), and only 1 reference point during the returning time. The navigation between these reference points was made using the sledgemeter and dead reckoning. 700 miles of the *Farthest South Journey* and only 11 geographical reference points! It was not difficult to find the way through.

In Tab. 11.4, I compiled Lt Shackleton's data together with the respective data of Captain Scott. One can readily notice that Captain Scott was taking respective measurements at a similar frequency, and also at times when Lt Shackleton's data was not available or possibly confusing, like on Jan. 9th 1909/1912. In essence, Captain Scott performed the bootstrap method and filled the gaps when it was needed, and possibly due to weather conditions took the theodolite reading.

Table 11.4. Captain Scott's (1911/1912) and Lt Shackleton's[1] (1908/1909) record of measuring latitude and longitude of his party during the South Pole and return journey. Days with a letter *V* indicate when the magnetic variation (declination) was measured.

Month	Day of the month
November	15(V), 21, 26(V), 26, 28(V), 29
December	1, 2, 4(V), 9(V), 15, 16(V), 18, 20(V), 21, 22(V), 23(V), 25(V), 26, 28, 31
January	1(V), 2, 3, 3(V), 5, 6(V), 7(V), 9(V), 9(V), 12(V), 13, 15(V), 16, 17

1 Ernest Shackleton, *The Heart of the Antarctic, Being the Story of the British Antarctic Expedition, 1907–1909*, Vol. I & II, W. Heinemann, London, 1909, Vol. II, *cf.* p. 425.

From Tab. 11.4, the investigative reader may also observe that Captain Scott's first position reading was made on Nov. 21st, 1911, 18 days after departure from the Hut Point. 18 days without taking a location measurement! Indeed, a perplexing question resurfaces: why could Cherry-Garrard not do it, read compass declination, and follow the right path all the way to the Pole?

The second observation from the above-mentioned table comes from the increased number of sights when the Captain Scott party was approaching the South Pole. It underlines the party's concern about its right location measured against the Pole.

The above, however, was not understood properly or just ignored by Huntford, who charged that Captain Scott's navigation methods "ignored what the specialists had to say"[50]

> In November 1909, A [Arthur]. R. Hinks, Lecturer in Surveying and Cartography at Cambridge University, held a seminar at the Royal Geographical Society in London on determining position near the Poles … It was attended by some highly qualified navigators and explorers … Scott was present, but he politely ignored what the specialist had to say.

Indeed, Captain Scott did ignore the elaborate presentation of Hinks, but he did not ignore a cable from Lt Shackleton on Mar. 23rd, 1909, in which he informed him of reaching the farthest point south (88°23′S) on Jan. 9th, 1909. Thus, Captain Scott certainly knew that there must be a practical, polished method that enabled Lt Shackleton to safely navigate that far.

In spite of this, this simple evidence was not obvious to Huntford, and he continued alleging

> He eventually arrived on the Polar Plateau using conventional Naval routine, which Bowers, a conventional Naval officer, obediently followed.

> What it meant was this. Every day [*sic*], around noon, Bowers took an exmeridian[51] [reference mine] sight for latitude, and in the evening another for longitude. The calculation of both is tedious, taking (in those days without pocked calculators) perhaps an hour … Scott clearly approved of this as praiseworthy devotion to duty. He did not consider that with the exhaustion of man-hauling at high altitude, rest was more important.

From every angle, Huntford's observations are incorrect. First, he makes a tautology by insinuating that Captain Scott should have adopted Hinks' tedious methods, and then that the Naval methods used by Lt Bowers were also tedious.

We know that Captain Amundsen was "easy" on the rigorousness of his geographical location sights. Despite that, Huntford ignores that Captain Scott, Captain Amundsen and Lt Shackleton were sledging just straight to the Pole. All of them, and as it was shown above in the case of Lt Shackleton and Captain Scott, used the most convenient and straightforward compass declination method, supported by dead reckoning. Captain Scott was vindicated, as he never missed a single depôt or point of reference.[52]

Evidently, Huntford also forgot to mention that Sir Clements Markham's tacit *votum separatum* was read before Hinks' seminar[53]

> I am inclined to say that when a high latitude has been reached by a traveller, whose object is the attainment of a still higher latitude, no matter in which hemisphere there are only two observations to be taken that are of any real importance in order to enable him to determine his position. These are for latitude, and these for ascertaining the variation of the compass. The latter is of great importance, for it enables the traveller to steer a straight and direct course toward the Pole.

It is evident that for Captain Scott, and for that matter the First and Second Return Parties, bootstrapping of geographical location and course worked just fine.[54] The investigative reader may also recall Lt Shackleton's *James Caird* open-boat sailing from the Elephant Island to South Georgia in 1916 and wonder about its navigation across the furious fifties. Due to huge waves and the time of the year (prone to cloudy skies), taking sights was indeed much more difficult than along Captain Scott's route.

The *James Caird* was launched from Elephant Island on Apr. 24th, 1916. The sights were taken on the following dates: Apr. 27th, 29th and May 4th, 7th to finally land on May 10th at Cave Cove of South Georgia, after sailing about 800 nautical miles. Interestingly, to sledge about 700 miles for his farthest point south result, Lt Shackleton made 11 sights, while during his *James Caird Journey* he only needed 4 sights! Nevertheless, the reader should not get confused about navigational skills. Frank Worsley was a fine navigator, but he also used a compass for navigation. In between sights, they directed the *Caird* according to compass declination until the next sight was taken and a new corrected declination estimated[55]

> We had no lamp for the compass and during the early days of the voyage we would strike a match when the steersman wanted to see the course at night; but later the necessity for strict economy impressed itself upon us, and the practice of striking matches at night was stopped.

The discussion presented above of navigational methods used by the Captain Scott party (parties) additionally questions Cherry-Garrard's attitude of not sledging south from One Ton Depôt in March 1912 during his First Relief mission. It is evident from Tab. 11.4 that the Captain Scott (and Lt Shackleton) parties were able to sledge great distances without taking theodolite sights and calculations. While sledging south, the first usage of theodolite was made on Nov. 21st (see Tab. 11.4). Thus, the first theodolite sight was made at 80°35′S, the fifth day since passing One Ton Depôt. It confirms that if Cherry-Garrard used a compass to navigate and sledged south from One Ton Depôt, he could meet or at least make a fair relief attempt. Instead, he was staying put and pondering how to write his journal to confuse the readers and remove any accountability for his actions.

Captain Amundsen was often prized over Captain Scott for his elaborate scheme of marking his depôts and route between them, and he accounted[56]

> From our experience of beacons built of snow, we could see that if we built such beacons now, on our way south, they would be splendid marks for our return journey; we therefore decided to adopt this system of land marks to the greatest possible extent. We built in all 150 beacons, 6 feet high, and used in their construction 9,000 blocks, cut out of the snow with specially large snow-knives. In each of them was deposited a paper, giving the number and position of the beacon, and indicating the distance and the direction to be taken to reach the next beacon to the north. It may appear that my prudence was exaggerated, but it always seemed to me that one could not be too careful on this endless, uniform surface. If we lost our way here, it would be difficult enough to reach home. Besides which, the building of these beacons had other advantages, which we could all see and appreciate. Every time we stopped to build one, the dogs had a rest, and they wanted this, if they were to keep up the pace.

Indeed, Captain Amundsen's account of building 150 beacons (cairns) along his route to the South Pole is at the first reading peculiar. It appears that Captain Amundsen was taking all possible precautions not to get lost. His plan was simple, "from 81°S we began to erect beacons at every nine kilometers."[57] It meant that Captain Amundsen divided each degree of latitude from 81°S to 90°S into $\sim{}^{1}/_{12}°$ distances. At each division, he built beacons (cairns). For navigation, Captain Amundsen used a compass and dead reckoning. For more precise geographical location estimation, he used a sextant and artificial horizon.

Captain Scott used a compass, dead reckoning, and theodolite. However, contrary to Captain Amundsen, the cairns (beacons) were built only at the depôt locations and up to the Mid Barrier Depot. Pending Captain Scott's orders to memorize variation of the compass as described at the beginning of the current subsection, it was Captain Scott's choice how he and his parties should navigate during the *South Pole Journey*.

In relation to the navigation methods of both explorers, Roland Huntford again takes the opportunity to criticize Captain Scott along the above-described lines[58]

> Amundsen's 'meridian sight' was a time-honoured and elegant way of finding latitude. It involved taking the altitude of the sun at local noon, when

> it was at its zenith. The calculations were simple, involving no mental strain. This is important. The brain is the single organ taking the greatest share [*sic*] of the metabolism. Therefore, as Amundsen realized, at the limits of survival, the brain must be protected from overwork [*sic*] so as not to waste energy.
>
> The meridian sight does not give longitude very well. At high latitude, this matters little. At 83°S. the degree of longitude is only 7.3 nautical miles against 60 at the Equator. Before GPS and laptops, finding longitude demanded much observation of the sun, tedious arithmetic and looking up tables. Here in the Antarctic it was not worth racking your brains for a few hundred yards of meaningless accuracy.
>
> The hidden irony here is that these principles were enunciated by A. R. Hinks, of the Royal Geographical Society in London. Amundsen, or rather Prestrud took note, but Scott did not. He acted as if he were on a ship at sea, at low latitudes.

Since Roland Huntford has no medical knowledge, his comment that the brain is "taking the greatest share of the metabolism" and thus "the brain must be protected from overwork" is indeed laughable if one recalls that thyroid hormones control metabolism, growth, body temperature, muscle strength, appetite, *etc*.

But we are here not to talk about metabolism, but rather sufficient navigational methods. Evidently Hinks, and more importantly Huntford, did not remember that since Captain Scott was following Lt Shackleton's route to the South Pole, he simply followed his bearings[59]

> Observations [Shackleton] for variation were taken whenever we took a latitude observation, and the results will be found recorded on the chart.

Since Lt Shackleton took 11 latitude observations (see Tab. 11.4) on his way to the South Pole, and only *one*[60] on the return journey, the route was sufficiently surveyed for the Captain Scott journey and navigation. Observations taken by Lt Bowers as listed in Tab. 11.4 were taken until the party passed Lt Shackleton's *Furthest South* mark, rather auxiliary measurements. After the Captain Scott team passed Lt Shackleton's last location, one readily notices from Tab. 11.4 that the number of location measurements was increased to sledge exactly to the Pole.

Interestingly, Captain Amundsen's team on the way to the South Pole measured the actual location 11 times[61] (before the Pole). The Captain Scott team measured the location about 24 times instances more than Lt Shackleton's results. It was work done by Lt Bowers, and unquestionably it consumed his energy, time, and time to rest. However, if one recalls that Captain Amundsen was to support navigation after every $\sim{}^1/_{12}°$ by making a 6-foot high beacon, a real question arises about energy expenditure. I have no data to make an educated comparison of the energy expenditure of Lt Bowers' calculations and Captain Amundsen's beacon building, but personally I would go with building cairns while exposed to elements as expending the greater amount of energy. It is my reasonable judgment, though with insufficient data.

One instance related to navigational skills illustrates Captain Scott's ingenuity when, during the *Discovery Expedition*, and after the book *Hints to Travellers*[62], an

essential guide for latitude and longitude theodolite reading had been published, Captain Scott discovered a new way to navigate[63]

> … I saw that there was no hope of working out our longitudes till we got back to the ship, it occurred to me that we might gather some idea of our latitude if I could improvise some method of ascertaining the daily change in the sun's declination.
>
> With this idea I carefully ruled out a sheet of my notebook into squares with the intention of making a curve of the sun's declination. I found on reflection that I had some data for this curve, for I could calculate the declination for certain fixed days, such as the day when the sun had returned to us, and the day when it first remained above our horizon at midnight; other points were given by observations taken at known latitudes on the glacier. To make a long story short, I plotted all these points on my squared paper, and joined them with a freehand curve of which I have some reason to be proud, for on my return to the ship I found it was nowhere more than 4′ in error. On the journey I did not place so much reliance on my handiwork as it deserved, for there is no doubt it gave us our latitude with as great an accuracy as we needed at the time.

To appreciate Captain Scott's proposition, I challenge the investigative reader to figure at this moment Captain Scott's method or propose a new one instead. One does not have to do it not at about –44°F[64] it can be done at say 0°F (–18°C).

In summary, it is evident that during the *South Pole Journey*, Captain Scott basically used a slowly varying magnetic variation (declination) to navigate. Until reaching the South Pole, he used Lt Shackleton's magnetic variation data. This conclusion is confirmed by the fact that all returning parties were exclusively navigating by compass (magnetic variation) and dead reckoning. On the way to the Pole, Lt Evans took location measurements using a theodolite. However, these observations were by no means used as the main guide in everyday sledging. It was rather a checking procedure. Anyone with a little practicality of navigating understands that one cannot navigate by only taking celestial observations. Navigation, while moving needs continuous observations of directions, and subsequent steering in the desired direction. In the early twentieth century, the only practical device for this was a compass. In Antarctica during the summer, by keeping the right time, one could navigate by observing the sun. However, on cloudy days or in whiteout conditions with poor visibility, the only navigational instrument was a compass, used accordingly by Captain Scott as well as by Captain Amundsen and Lt Shackleton.

In relation to the above account, and recalling Cherry-Garrard's non-believable inability to read a compass and thus following its arrow (magnetic declination), it is pertinent to add that this twisted notion freely propagated until the present day. Recently, Karen May re-discovered that[65]

> Cherry-Garrard, however, could not navigate beyond the basic use [*sic*] of a compass. Fortunately, locating One Ton Depot would not require advanced navigational skills. According to Headland (R.K. Headland, personal communication, 15 June 2011), One Ton could be found easily on the southbound course, at a point where the peak of Mount Erebus (an ac-

> tive volcano, often identifiable by a crown of smoke) was just about visible. However, south of One Ton, the terrain soon devolves into a featureless white plain where a thorough knowledge of navigation is crucial. Beyond One Ton, Cherry-Garrard could not easily proceed.

With just a few lines produced by May, the entire issue of navigation gets twisted and entirely confused. If Cherry-Garrard was just following a magnetic declination, he would arrive at any location along Captain Scott's route in continuous *whiteout* conditions, using just a compass and a previously recorded magnetic declination at a given location (traverse between nearest-neighbor depôts). If for some reason Cherry-Garrard could not have learnt compass navigation before the *Southern Journey* he could have, at many occasions, tried to figure out (or be taught) this *simple* navigational skill during the journey. Contrary to May's/Headland's uneducated guess, no "thorough knowledge of navigation [was] crucial". Just knowing the difference between true north and magnetic north was sufficient. In any case, Cherry-Garrard had a line of marker cairns extending all the way to the Mid Barrier Depot, ensuring that with clear conditions he would not have even needed a compass.[66] Additionally, it was not R. K. Headland who first pointed out that the peak of Mount Erebus (or its smoke) could serve as a navigational beacon. For example, Lashly commented in his diary[67]

> We shall soon be looking for land ahead, which will be Mt. Discovery or Mt. Erebus, we have 155 miles to go to Hut Point.

Furthermore, a simple calculation of the distance to the horizon would tell anyone interested in its value that the visibility distance from Mount Erebus is about 119 miles (geographical), almost precisely to the mile as the sledging distance between Hut Point (*via* Corner Camp) to One Ton Depôt[68]

11.1.6. Gale at 83°S

In this subsection, I return to Captain Scott's own account of the reasons for the disaster presented in his *Message to the Public*. In subsection 11.1.1, I presented an analysis of Captain Scott's assertion from the Message *to the Public* that

> 1. The loss of pony transport in March 1911 obliged me to start later than I had intended, and obliged the limits of stuff transported to be narrowed.

It was shown there (subsection 11.1.1) that although some ponies had been lost due to different events, Captain Scott for his *South Pole Journey* had enough ponies for his 144-days schedule. Actually, it is hard to figure out the relationship between the number of ponies and the date to launch the *South Pole Journey* as suggested by Captain Scott. The window of opportunity was actually controlled by the weather, and by human/animal abilities of sledging in different conditions. By selecting ponies as the main draught animal supporting his journey, Captain Scott already defined and narrowed his window of possible departure dates. He also limited the time during which the effective use of ponies was possible.

Despite these shortcomings of employing pony transportation, one should observe that indeed the ponies were a *real salvation*, provided that Captain Scott was

trying to find one. The investigative reader may recall my analysis in Chapter 9 of food and fuel rations distributed and available to Captain Scott along the route to and from the Pole. It was shown there that after sledging with a light load down the Beardmore Glacier and complaining about food shortages and want, the party took only a *little* of the horse meat left at Shambles Camp, and none at all from the other locations where it was available. Even though we do not know exactly how much horse meat was depôted at Shambles Camp (Camp # 31) and consumed by the dogs and returning parties, I believe that the five ponies shot there should have met all the parties' expectations. This will be covered in greater detail in subsection 11.1.10. Additionally, one has to remember that a sixth pony was shot at Camp # 24, not far from Shambles Camp. Given how much the pony meat was welcomed by the polar party as per Captain Scott's diary, it is strange that he did not attempt to pick up any pony meat from Camp # 24, or any of the other locations. It is evident from Captain Scott's journal that he planned to use ponies as long as they had fodder. Thus, Captain Scott with ponies and Captain Amundsen with the dogs presented a utilitarian planning of their use (see also subsection 3.1.2).

It is certain from the above description, as well as from the discussion presented in Chapter 9, that because of the shot and disassembled ponies, there was salvation at Shambles Camp (and the other places on the way to One Ton Depôt) due to there being plenty of pony meat. However, Captain Scott collected relatively little pony meat from Shambles Camp, and none at all from the other locations.

However, before the pony's meat could be collected and consumed by Captain Scott's returning party, the ponies travelled a short distance to the Shambles Camp after being stopped by the four days blizzard. Captain Scott in his *Message to the Public* attributed this blizzard as one of the causes of his expedition's disaster, and he accounted

> 2. The weather throughout the outward journey, and especially the long gale in 83°S., stopped us.

Yet again, Captain Scott accounts in an ambiguous way by saying that the weather is to blame for the disaster. Since Captain Scott's attribution is so vague, he provides an example by bringing to the Public the four days blizzard.

In the previous chapters, and especially in Chapter 9, I discussed the overall performance of the Captain Scott party and supporting parties in terms of sledging progress measured by the fraction of days relative to the 144-days schedule. Now, I will use results obtained there to argue that indeed a gale at 83° (Dec. 5th through 8th, 1911, see Fig. 11.8) did not significantly and meaningfully influence the Captain Scott party enough to be called a factor responsible for its disaster.

We can observe the importance of the gale at 83°S to Captain Scott's disaster in connection with the temporary impact on sustained sledging velocity. We have already seen many times how confusing weather with climate leads to great confusion, uneducated reasoning, and data manipulation. Some of these cases resulted from a lack of knowledge, but most resulted from obscure misconduct and data dragging.

Captain Scott's attribution of a gale at 83° to his final disaster is an additional example of false reasoning. Is it possible that 3% of the total sledging journey, which apparently did not go as planned but did not result in disaster, could fatally spoil the

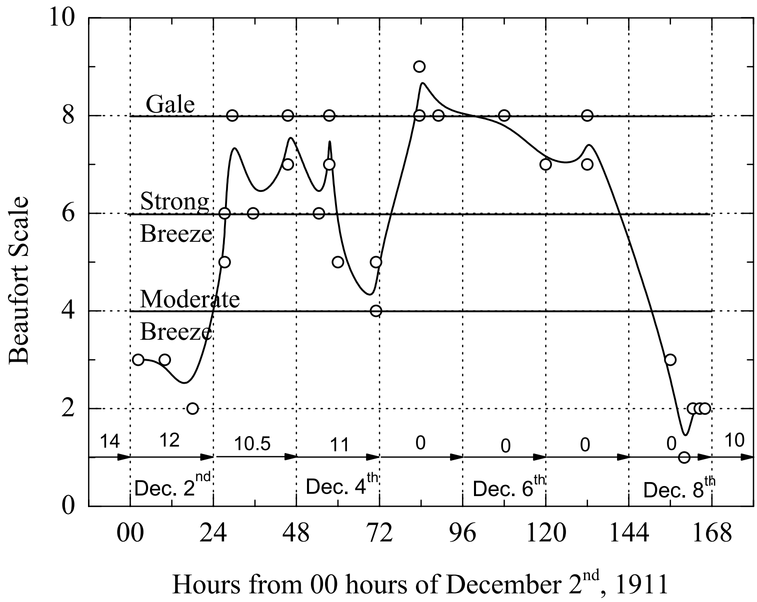


Figure 11.8. The plot of wind strength in the Beaufort scale (0–12) measured by the Captain Scott party from 00 hours of Dec. 2nd, 1911. The range of the Gale (62–74 km/h), Strong Breeze (39–49 km/h) and Moderate Breeze (20–28 km/h) are also indicated for reference. Wind strength was taken from Dr Simpson Vol. III.[1] The solid black line "connecting" data is the B-spline line. The daily sledging distance in geographical miles is given above arrows with respective dates. The investigative reader, in conjunction with this figure, may consult Dr Susan Solomon's account of the Gale at 83° to find that Dr Solomon lied to the readers about the severity of the Gale at 83°. She described "they estimated the wind speed at up to eighty [*sic*] miles per hour.[1]"[2] To justify her lie, Dr Solomon introduced reference 1 (Simpson Vol. III). For a more analytical description of Dr Solomon's lie, see Fig. 4.15 and its discussion. Dr Solomon's lie was eagerly and without scrutiny repeated by Sir Ranulph Fiennes.[3]

[1] George C. Simpson, *Meteorology*, Vol. III, Tables, Harrison and Sons, Ltd., London, 1923, *cf.* p. 624–625.

[2] Susan Solomon, *The Coldest March: Scott's Fatal Antarctic Expedition*, Yale University Press, New Haven, 2001, *cf.* p. 178.

[3] Ranulph Fiennes, *Captain Scott*, Hodder and Stoughton, London, 2003, *cf.* p. 282.

rest? The investigative reader may say that an even *much* shorter time event such as a fall into a crevasse could finish off the whole expedition. Indeed, this might be the case, however in relation to the question at stake we are not dealing with a black swan (extremely rare)[69] event.

However, how could Captain Scott (and thus we) know that the gale at 83°S was a rare event? The only data available to Captain Scott was the respective data of Lt Shackleton's *Farthest South Journey*, which was just temporary weather data. On Dec. 10th, 1911, Captain Scott noted in his journal "It seems an extraordinary difference in fortune, and at every step S.'s [Shackleton's] luck becomes more evident." Since Lt Shackleton did not experience gales at the foot of the Beardmore Glacier,

Captain Scott was fallaciously expecting the same. The gale struck his party, and Captain Scott attributed it to his and his party's bad luck. However, such an association is incorrect since there is no educated relationship between luck and the weather.

Is there any measure which could help us to reassess of the influence of gale at 83°S on Captain Scott's expedition? Certainly, Captain Scott could not see the answer when on Dec. 5th he commented

> How great may be the element of luck! No foresight no procedure could have prepared us for this state of affairs. Had we been ten times as experienced or certain of our aim we should not have expected [*sic*] such rebuffs.

Interestingly, Captain Scott missed the point related to the nature of the weather. Since he already spent a year in Antarctica, did he find a relationship between frequencies of gales and the time of the year? Of course, he did not. In section 1.4, I have shown that the wind events, including gales, are self-organized criticality phenomena, and one cannot find an average frequency of such wind events, as such an average *does not exist*.

However, in Captain Scott's account above, he did not look for a scientific explanation, but rather to a self-exploratory description of how nature 'rebuffed' his advances, while Lt Shackleton was sledging three years before in fine weather conditions.

Was it justifiable for Captain Scott to reference the gale at 83°S as an important factor in his company's disaster? The above analysis was not able to find a definitive answer, but pointed the search in the right direction by bringing up the importance of looking at long-term effects of temporary events, in this case a gale at 83°S.

The investigative reader may readily recall subsection 11.1.4 and Chapter 9, where analyses of sustained sledging velocities as a way of looking at the sledging performance of Captain Scott's party were presented. In a way, it is like looking at 'climate' of man-hauling rather than at the 'weather' of the same process. I hope that the investigative reader will see the objective of my approach.

By looking at Figs. 11.3 and 11.4, one can see and conclude that in the long run, the Captain Scott party was able to maintain a fine sustainable sledging velocity. The temporary sledging distance setbacks were offset by an equally temporary resurgence, substantially exceeding the 144-days schedule. This was certainly true until, on the way back, Captain Scott approached the Beardmore Glacier on or about of the 92nd sledging day. From the 92nd (Feb. 2nd, 1912) sledging day, the Captain Scott party's sustainable velocity was *systematically dropping down*.

The reader may observe the relationship between sustained sledging velocity and the notion of climate, as its variables are estimated at time $t \to \infty$.[70] During a given period of time, the temperature at a given location may fluctuate around the climatological average, which is a meaningful variable. In similar fashion, though driven by man-hauling and sledging actions, Captain Scott, in the long run, maintained a suitable sledging velocity. Therefore, Captain Scott's assumption of the gale at 83°S as a one of causes of his party disaster is not justifiable.

11.1.7. Soft Snow at Beardmore Glacier

It happens of course that circumstances may make an action miscarry to a greater or lesser degree. In the case of arson, for instance, the fire may not catch or alternatively it may take hold further than the incendiary intended. In spite of this, however, we must not make this a distinction between good and bad luck, since in acting a man must lay his account with externality. The old proverb is correct: "A flung stone is the devil's". To act is to expose oneself to bad luck. Thus bad luck has a right over me and is an embodiment of my own willing.

Georg W. F. Hegel[71]

Again I turn to Captain Scott's *Message to the Public* and its third point (cause) of disaster, which reads

> 3. The soft snow in lower reaches of glacier again reduced pace.

Even without careful analysis, Captain Scott's attribution of snow conditions at the Beardmore Glacier to the final causes of disaster immediately appears to be unfounded and not remotely possible. This particular reason for the disaster is directly related with the Gale at 83°S event described in subsection 11.1.6. This wind event was apparently a complex one. It was not only a high-velocity blizzard accompanied with snow drift, but also with snowfall. The party's meteorological record reads:[72]

> [Dec. 5th, 1911] Thick heavy s. [snow] and drifting drift: heavy gale; very heavy drift. Snow in large flakes and extraordinarily deep drifts: everything very wet … more like rain than snow. s. [snow] very much like sleet in wetness
> [Dec. 7th, 1911] Phenomenal snow fall, large, soft wet flakes, like sleet. Everything in and around and about camp, tents, etc., saturated with water: snow sticks to shovels like plaster
> [Dec. 8th, 1911] During a.m. blowing fresh from SSE, with much snowfall … Snow fall round camp tremendous, drifts 6 ft. high, consisting of soft, squashy snow. Good sliding on ski [*sic*], but very heavy for walking. 10h: Snow ceased.

Additionally, by consulting Captain Scott's journal during the Gale at 83°S and the following days, one confirms the difficult snow conditions created by the Gale at 83°S accompanied by heavy snowfall. In general, due to the low temperatures the humidity of Antarctica's air is low or very low, and thus the possibility of snowfall is equally low or null. The very low or null humidity of the Antarctic continent (especially its interior) has been well known since the *Discovery Expedition*.[73]

However, were these soft snow conditions at the lower reaches of the Beardmore Glacier a *reasonable* cause of the Captain Scott disaster? Since Captain Scott is not saying how these conditions influenced his party at the early stage of the *South Pole Journey*, we are left speculating. It seems apparent that Captain Scott must be refer-

ring to slowing down his party and possible additional energy expenditure due to heavy sledging.

Let me look at two plots of Captain Scott's parties' performance as already discussed and depicted together on Fig. 11.9. The upper figure depicts the fraction of days the Captain Scott party was relative to the 144-days schedule. One can see that right before the party approached the foot of the Beardmore Glacier, the party was about 2½ (2.55) days ahead of schedule. However, right after the Gale at 83°S ended, the party was about 1½ (1.46) days behind the schedule.

Even after the party was able to continue sledging up the Beardmore Glacier, its progress was rather erratic and below the expected rate. The party was gradually falling behind schedule. This apparent "below" assumed sledged daily distances lasted almost until the party reached the upper glacier. It was indeed a setback. However, was it so important that it permitted Captain Scott to enlist it as a reason for disaster?

It appears that the Gale at 83°S as a reason for the disaster is incorrect. Following this, a gradual falling behind of the schedule had meant that the First Return Party sledged back to Hut Point/Cape Evans. Its journey was not influenced in any noticeable way by soft snow at Beardmore Glacier, and the party rapidly returned. Not long after, the Second Return Party followed, and despite Lt Evans' illness, safely returned to expedition quarters. It appears again that the sledging difficulties at the lower reaches of the glacier did not limit the Second Return Party's sledging range. The First and the Second Return Parties sledged 890 and 1202 miles, respectively. Lt Shackleton sledged 1303 miles[74] and Captain Scott sledged between 1358 and 1347 miles.[75]

To get more insight into the real influence of snow on Captain Scott's journey at the lower reaches of the glacier, one should look at the sustained sledging velocity of his party. This measure is indeed an investigating tool for measuring the performance of expeditions. In the lower part of Fig. 11.9, I have presented daily distances sledged by the Captain Scott party, together with a curve representing the sustained sledging velocity of this party. The solid line and points represent respective data during the Gale at 83°S and immediately after. The investigative reader may see that despite a significant and prolonged drop in daily distances, Captain Scott's overall performance did not change in any noticeable way, as illustrated by smooth changes of sustained sledging velocity. The reader may notice and suggest that before the trouble of the Beardmore Glacier, the Captain Scott party for a good time was sledging with velocities much higher than those envisioned by the 144-days plan. This over performance was later effectively nullified by the sledging performance at the glacier. Therefore, in a long run measured by the 144-days sledging plan, the influence of soft snow at the Beardmore Glacier was small and did not influence in any significant way Captain Scott's overall performance.

The same figure reveals a new and entirely unrecognized feature of Captain Scott's sledging performance. I will discuss this feature further in Chapter 12. This feature observed as a *steady decrease of sustainable sledging velocity* from the moment when Captain Scott's returning party approached the Beardmore Glacier on or about day 92 (Feb. 2nd) as depicted on Fig. 11.9. This systematic decrease of sustainable velocity is overall unbroken and lasts to the end. What is indeed surprising is that at no instance does Captain Scott make reference to, or take notice of, this sustained sledging velocity downfall which eventually led to the party's deaths.

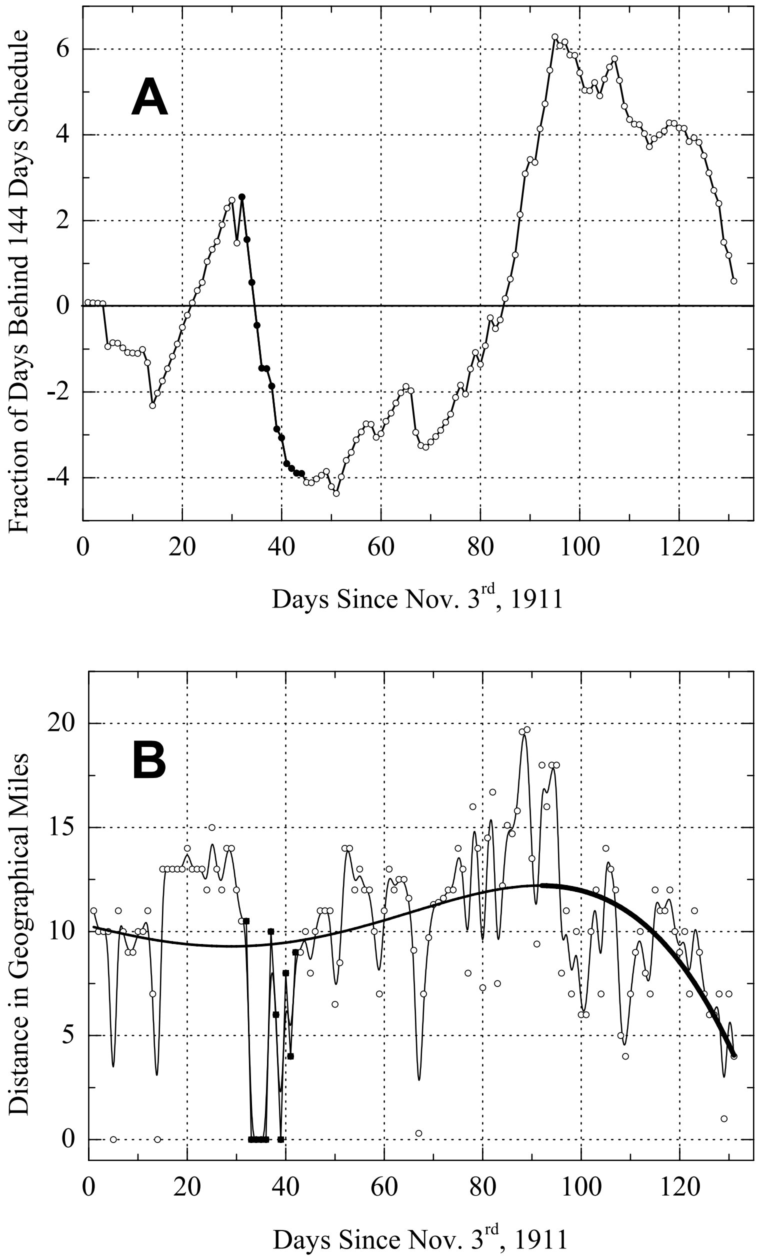


Figure 11.9. The fraction of days relative to the 144-days schedule (**A**) and sledged daily distance (**B**) of Captain Scott's party during the *South Pole Journey*. Data reported by Captain Scott is represented by open circles (○). Respective data Dec. 4th–Dec. 17th, 1911 are depicted by (•) circles and connected by a black thin solid line. In the case of the bottom figure, the daily sledged distances are approximated by a B-spline function. The solid black line (—) across the bottom figure represents sustainable man-hauling velocity. The black thick solid line (**—**) represents the sustained Captain Scott velocity right after the party started sledging down the Beardmore Glacier.

How is it possible that Captain Scott enlists the soft snow at the Beardmore Glacier as an actual cause of his disaster, but *entirely ignores* the systematic and long-term velocity decrease, as depicted on Fig. 11.9 B, since the party started to descend the Beardmore Glacier? This process of systematic velocity decrease ultimately led the party not reaching One Ton Depôt and presumably led to their deaths. Captain Scott in his journal was able to ponder many issues, but he could not detect and comment on the life or death issue of a systematic drop of the sustained velocity of his party? It is indeed incomprehensible.

On Dec. 16th, 1911 (44th sledging day), Captain Scott felt compelled to comment

> We must push on all we can, for we are now 6 days behind Shackleton, all due to that wretched storm.

This casual comment caused a row between Sir Ranulph and Huntford. The presence of a dispute over such a small comment by Captain Scott related to soft snow at the Beardmore Glacier may suggest to the reader great sophistication and attention to the detail by Huntford and Sir Ranulph. However, this is not the case, and both missed the point due to their rabidity. Sir Ranulph in his Chapter 19 titled *The Last Word* attempted to debunk Huntford's expertise. According to Sir Ranulph, the first reason is that 'Huntford presented himself as a man with practical snow and ice experience'. While presenting Huntford's lack of practical experience, Sir Ranulph comments[76]

> Huntford alludes many times to Scott battling with Shackleton as 'with an imaginary foe'. He suggests that Scott kept comparing his progress with that of Shackleton, 'the ghostly rival', in order to 'sneer' at Shackleton. Having completed many expeditions over terrain where some predecessor has been, I know that the most natural and satisfying activity each day is to compare progress with that of the previous traveller. This does not involve 'sneering', merely checking progress against some known yardstick.

Let me first look at Captain Scott's original comment cited above, and observe that on Dec. 16th, 1911, his party was 6 days behind Lt Shackleton. This checking can be done without practical experience in polar regions. Indeed, Captain Scott was very precise about his mileage estimations. On Dec. 16th, 1908, Lt Shackleton's team already had sledged 466.63 miles (see Fig. 4.12) and on the same day but three years later Captain Scott sledged 405 miles (see Fig. 4.12).

It is a difference of 61.63 miles on Dec. 16th, 1908 and 1911, respectively between the Lt Shackleton and Captain Scott parties, and that is all that can be reasonably said. Any further departure from the interpretation of the 61.63 miles figure is a matter of speculation and depends on where one is wishing to arrive.

Captain Scott knew he was 6 days behind Lt Shackleton. How did he arrive at this figure? The answer is simple, and related to his 144-days plan, which gives a daily sledging velocity of 10.1 miles/day, and it gives about 6 days lag behind Lt Shackleton. However, Lt Shackleton's sledging schedule was *different* than Captain Scott's, and for that reason the comparison was almost meaningless.

Lt Shackleton assumed that he would need 93 days (contrasted with Captain Scott's 144 days) to reach the Pole and return, with the contingency of possibly running for 120 days. Thus, Lt Shackleton assumed sledging with a daily velocity in the range of 16.1–12.5 miles per day. Therefore, and according to these estimates on

Dec. 16th, Captain Scott could fairly assume that on that day (44th day of journey,) Lt Shackleton must be somewhere between 708–550 miles from Hut Point. However, he was not there, and he was at 466.63 miles distance from Hut Point. Therefore, Lt Shackleton was sledging at a much slower velocity than assumed. On Dec. 16th, 1908, Lt Shackleton was 14.7 and 6.6 days, respectively, behind his own schedule and Captain Scott's schedule. On the same day but in 1911, Captain Scott was 3.9 days behind his own schedule, and was comparing his own progress not with Lt Shackleton's schedule, but with his actual position. This is indeed very confusing, twisted reasoning and pointless divagation by Captain Scott.

Two days later on Dec. 18th, Captain Scott continued in a more unbeaten manner

> If we can keep up the pace, we gain on Shackleton, and I don't see any reason why we shouldn't, except that more pressure is showing up ahead. For once one can say 'sufficient for the day is the good thereof.' Our luck may be on the turn I think we deserve it.

Captain Scott's remark above clearly shows that his concerns were false and not focused on his own expedition. Captain Scott had a 144-days plan, and all arrangements were set accordingly including depôts and their food and fuel rations. For that reason, Sir Ranulph's only valid yardstick was Captain Scott's schedule, daily distances and a respective fraction of days relative to this schedule. Additional distance considerations could only serve as intellectual amusement.

Captain Scott's above remarks confirm, though in a peculiar way, that he was very much aware of sledging progress as far as the distances were concerned. At any rate, even without such comments, one must assume that during Captain Scott's *South Pole Journey*, he *must* have been steadily and seriously concerned with daily distances.

For that reason, and after consulting Fig. 11.9 B, where the sustained Captain Scott sledging velocity is depicted, one observes that from about the 92nd sledging day, the party started to descend the Beardmore Glacier, its sustained velocity steadily falling. Naturally one would expect that Captain Scott must have noticed this lasting trend and commented about in his journal. Conspicuously, none of that happened.

Summing up the results depicted on Figs. 11.9 A and B, one can see that even though the sledging conditions at the lower Beardmore Glacier were difficult and caused the delay, the overall progress of Captain Scott's party expressed by sustained sledging velocity did not change, and in the long run the Captain Scott party was not observably influenced by soft snow at the Beardmore Glacier.

11.1.8. The Fifth Man

> *Whatever* [*sic*] *the case may have been, this* [the Fifth Man – KS] *remains one of Scott's most controversial actions.*
>
> Stephanie Barczewski[77]

Captain Scott's 144-day plan assumed that from the foot of the Beardmore Glacier, the main task group would constitute 3 sledging parties of 4 men each. All arrangements, like the unit size of food rations, the amount of fuel, and tent size were set

accordingly. However, Captain Scott's final decision as to who in the party of four would participate in the final push for the Pole was unknown.

On Jan. 3rd, 1912 Captain Scott casually commented in his journal

> Last night I decided to reorganise, and this morning told off Teddy Evans, Lashly, and Crean to return. They are disappointed, but take it well. Bowers is to come into our tent, and we proceed as a five man unit to-morrow.

and on the next day he added

> The second party had followed us in case of accident [*sic*], but as soon as I was certain we could get along [*sic*] we stopped and said farewell. Teddy Evans is terribly disappointed but has taken it very well and behaved like a man. Poor old Crean wept and even Lashly was affected.

Captain Scott's comments are curious. Why did the Second Return Party (Lt Evans, Lashly and Crean) during part of Jan. 4th follow Captain Scott's South Pole party? This did not happen when the First Return Party parted. But here, Captain Scott anticipates an accident and after being "certain [that] we could get along" he orders Lt Evans' party to return. Captain Scott's account is unclear, but one can only suppose that he was testing how the Fifth Man, Lt Bowers, and the rest would pull sledges in a five-man arrangement. That was indeed Captain Scott's contingency action.

Captain Scott was criticized because by taking the Fifth Man to the Pole, he artificially and in a not desirable way increased time spent on rearranging what was set up for 4 man parties. There is no question that cooking time for 5 people was longer than for 4. However, this smart observation does not mean that Captain Scott was in error by adding the Fifth Man.

Stunning honesty and an equally stunning uneducated "conclusion" came from the formally educated[78] historian Dr Stephanie Barczewski, when she accounted the Fifth Man issue as "whatever [*sic*] the case may have been, this remains one of Scott's most controversial actions". With "whatever," Dr Barczewski argues what no one, including Captain Scott, could argue. It may be that or that, and it is not important what and why; taking the Fifth Man to the Pole was anyway Captain Scott's biggest error.

A more suitable question arises: was there a special reason for Captain Scott to plan (assume) beforehand that the sledges would be dragged by a four-man party? During the *Discovery Expedition*, the party was a three-man party (Captain Scott, Dr Wilson and Lt Shackleton), and during the *Nimrod Expedition* the southern party was a four-man party (Lt Shackleton, Marshall, Adams and Wild). The *Winter Journey* to Cape Crozier (the most easterly point of Ross Island) was a three-man party (Dr Wilson, Lt Bowers, Cherry-Garrard) adventure.

Throughout this book, I analyzed Captain Scott's party performance measured by different sledging velocity representations. Particularly interesting was the recasting of sledging velocities in the form of a fraction of days relative to the 144-days schedule, as depicted on Figs. 9.1, 9.3 and 9.4. This re-casting illustrated the sledging performance of parties. However, which sledging arrangement – 1 man, 2 men, …, 5+ men – was the most effective means of transportation? Modern adventures in Antarctica while travelling solo or in small groups usually go 1 man per sledge. In

the past, the arrangement of three to five men simultaneously dragging one sledge was effectively used.

Although Roland Huntford was not the first who raised the issue of the Fifth Man,[79] he severely and unjustly, as I will show in a moment, criticized Captain Scott for taking the Fifth Man for the last leg of his journey to the South Pole[80]

> Scott had based [*sic*] his plans on taking four men to the Pole. Now, at the last moment, he unexpectedly added a fifth and considerably increased his risks [*sic*]. His food would only last for four weeks instead of five but, as he casually remarked, "it ought to see us through."

It is worth pausing to look carefully at Hundford's description. First, Huntford makes the unsupported conjuncture that somehow Captain Scott was planning "on taking four men to the Pole". Even though it is circumstantial evidence, it is false. There is no logical conjuncture between sledging with a four men arrangement, including packing rations in four-man units, and the number of people actually going to the Pole. To think like that is simplistic. It is certainly possible that due to the volume of food/fuel rations and general sledge packing arrangements, the X.S. one week units for four men resulted. To determine extreme values is the basic objective of optimization expressed by the variational principle.

Second, Huntford *implicitly* assumes that the food/fuel variable was the only variable which determined Captain Scott's journey. We know already that it was not the case, and that the sledging velocity was an additional variable; indeed, it was Captain Scott's *contingency measure*.

To advance his point, Huntford continued[81]

> It was not only the polar party that Scott had put at risk. He had thrown his whole intricate organization dangerously out of joint. Everything was arranged for four-man units: tents, gear, cookers, fuel, and he depots along the route … Scott himself offered no explanation.

In both of the above citations, Huntford makes reference to increased risks. However, without specifying the nature of these risks, it is impossible for the reader to assess these risks. Huntford's vagueness and failing to mention the possible risks is seductive, but not appealing to the reader's curiosity.

It is a peculiar characteristic of Huntford to account for Captain Scott's actions when it suits Huntford's agenda, and he is critical of Captain Scott's actions for implementing or nor implementing changes and adjustments to the initial plans. Either way Huntford is critical of Captain Scott, and adds for example that "Scott himself offered no explanation". Explanation of what Captain Scott did not offer? Did Captain Scott – or for that matter Huntford – explain why "everything was arranged for four-man units". Is the "four-man unit" a magic number for sledges in Antarctica? Of course, it is not, and this was practically proven many times. Even Huntford's hero Roald Amundsen sledged to the Pole in a five-man team: Captain Amundsen, Bjaaland, Hanssen, Hassel and Wisting.

Before critically answering Huntford's false conjunctures about the Fifth Man, let me briefly account for the other authors' views. Various strange "explanations" have been proposed to account for the reasons why Captain Scott's final party consisted of five men. I will not dwell on all of them and just briefly review the most deceptive

and seemingly educated account presented by Sir Ranulph Fiennes. Apparently Sir Ranulph felt compelled to rebut Huntford's conjunctures, and also to present his own pseudo-genuine picture of events[82]

> Exactly when Scott decided to take five men rather than four is not something clarified by his diary or any other record. I suspect he waited until the last moment before making up his mind but that he had long since worked out that five was a workable option and had discussed it with Wilson at least as early [*sic*] as the time of Wilson's sketch of five manhaulers on one sledge.

Indeed, very circumstantial evidence. To support it, Sir Ranulph brings the reader to the attention of his Fig. 67 depicting Dr Wilson's watercolor painting as shown on my Fig. 11.10 Wilson's painting is subtitled by Sir Ranulph in the following way[83]

> Fig. 67. The sketch by Edward Wilson which indicates that long before setting out Scott contemplated taking five, not four, men on the final Pole Journey.

Sir Ranulph's inference is circumstantial evidence of circumstantial evidence. Indeed, he has propagated the cherry picking fallacy, as we have seen many times before with the prime fallacious thinker, Dr Susan Solomon. The investigative reader can easily find several additional Dr Wilson drawings/paintings depicting only three men pulling sledges. Following Sir Ranulph's fallacious thinking, one could easily suggest that Dr Wilson envisioned long before that the final Captain Scott party would constitute three men (see Figs. 11.10, 11.11 and 11.12). Sir Ranulph would then object and suggest that Dr Wilson was contemplating his *Winter Journey* to Cape Crozier. Either way, it is cherry-picking, a form of fallacious thinking usually used by individuals like Sir Ranulph or Dr Solomon to prove an otherwise unprovable thesis.

Re-rendering history is not a new subject, and it has been done many times. As Sir Ranulph used a pictorial rendering of the envisioned number of sledges to go to the Pole with Captain Scott, let me refer to a similar pictorial rendering. Nikolai Yezhov was head of the NKVD (from 1936–38), the Soviet secret police under Joseph Stalin. Eventually, he was arrested and executed in 1940 on charges of anti-Soviet activity. At about the same time, the previously taken photo of Yezhov with Stalin, see Fig. 11.13, was rendered conveniently absent, and a picture of Stalin alone was presented by the censors.

Now after the above critical expounds, it is time to look at the issue of the Fifth Man from an analytical point of view. A good part of this task was already presented in Chapter 9, where I analyzed the logistics of Captain Scott's *South Pole Journey* from a food/fuel perspective. It was shown there that despite Captain Scott's comments about fuel shortages, the party in reality did not experience shortages, at least before middle and late March 1912. The key part of my analysis was based on and supported by looking at the relation between the scheduled and actual food/fuel rations, and scheduled and actual sledging velocity.

While thinking about the Fifth Man issue, it is useful to make one more time a *cæteris paribus* assumption: that after the departure of the Captain Scott party (3×4 man) from the foot of the Beardmore Glacier, the *only* variable was sledging

Figure 11.10. Reproduction of Sir Ranulph's "Fig. 67. The sketch by Edward Wilson which indicates that long before setting out Scott contemplated taking five, not four, men on the final Pole Journey."

Figure 11.11. One of Dr Wilson's watercolor paintings.

Figure 11.12. The other Dr Wilson painting.

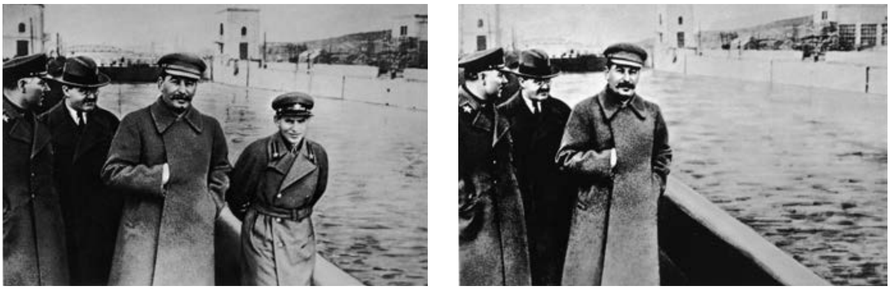


Figure 11.13.[1] An actual historical picture and its re-rendered result. Father of Nations, Joseph Stalin, at center, and Nikolai Yezhov on the right. The man to Stalin's left is Vyacheslav Molotov. Only a few years ago, the news from North Korea emerged[2] that tens of thousands of articles have disappeared down an Orwellian memory hole (from *Nineteen Eighty-Four*).

[1] http://en.wikipedia.org/wiki/Joseph_Stalin
[2] http://www.indexoncensorship.org/2013/12/north-korea-deleting-history

velocity. Although I did say that an explicit *cæteris paribus* assumption is made, one should readily recall from Chapter 9 that indeed it was Captain Scott's contingency plan on many occasions! Changing sledging velocity was changing the frequency of reaching the food/fuel depôts. One must understand that it does not mean that Captain Scott was in full command of sledging velocity. Of course the sledging velocity is derived of many physical variables (friction, temperature, wind, weight, surface gradient, *etc*.). However, it is not only these variables; feasible daily sledging distance also depends on these variables, but also upon the party endurance and daily sledging time.

Now let us look in more detail at distances and sledging velocities of the Captain Scott party departing from the Lower Glacier Depôt (83°36′S, 171°E). It was camp #32, and the Captain Scott party left it on Dec. 11th, 1911 at 8:30 am. Since Captain Scott was following Lt Shackleton's route, he knew the distance from this camp (#32) to the Pole to be about 384 miles (see Tab. 9.1).

According to the 144-days sledging scheme, he expected to sledge from Lower Glacier Depôt to the Pole in about 38 days (~5½ weeks) (384 [miles]/10.1 [mile/day]). It meant an 11 weeks round journey. If only one four-man party was selected for the journey, the initial weight of food/fuel rations after the Second Return Party went back was *prohibitive*. That this sledging limit was nearly fatal was proved by Lt Shackleton three years earlier. Thus, Captain Scott envisioned that three four man parties would depart from the Lower Glacier Depôt, carrying altogether 21 food/fuel units. The weight of food/fuel units, combined with the weight of supporting gear (sledges, tents, *etc*.), represented the *maximum* what the men could drag in a sustained way.

In Tab. 11.5, I summarized *The Four Man Scenario* in what can be called the four-man plan according to Captain Scott's 144-days schedule of going to and returning from the South Pole. For further examination, one should simultaneously consult Tab. 9.1, which summarizes *post factum* Captain Scott's data.

Examining Tab. 11.6 *The Five Man Scenario*, one can easy notice that indeed Captain Scott's original sledging scheme was simple and straightforward. Roughly

Table 11.5. The Four Man Scenario – the Four Man Plan (144-days Schedule).

1. Take 3 × 4 (sledges × man) party with 21 units of food/fuel from the Lower Glacier Depôt.
2. Sledge up the Beardmore Glacier, and after reaching the Antarctic Plateau establish the Upper Glacier Depôt.
3. Send back the First Return Party, and proceed with 2 × 4 man party. Depôt 2 × 2 units.
4. At the distance of about two sledging weeks from the Pole, establish next depot and send home the Second Return Party. Proceed toward the Pole with 1 × 4 man party. Depôt 1 × 2 units.
5. Take 2 × 2 units and sledge to the Pole. After reaching the Pole, return and use depôted units.

Table 11.6. The Five Man Scenario – the Fifth Man Plan (the Actual Schedule)*

1. Take 3 × 4 (sledges × man) party with 21 units of food/fuel from the Lower Glacier Depôt (–83.6, 171).
2. Sledge up the Beardmore Glacier, and after reaching the Antarctic Plateau establish the Upper Glacier Depôt (–85.1166, 163.0800).
3. Send back the First Return Party, and proceed with 2 × 4 man party. Depôt 2 × 2 units.
4. At a distance about two sledging weeks from the Pole, establish next depôt (Three Degree (3°) Depôt), Depôt 1¼ + ¾* units. Send back the Second Return Party (1 × 3) and take to the Pole (1 × 5) party.
5. At a distance about two sledging weeks from the Pole, establish next depôt 1½° (88°29′S) and depot 1¼ unit.
6. Since depôted and units taken to the Pole are not sufficient according to 144-days plan, increase sledging velocity to cover extra distance. Keep 144-days scheme food/fuel allotted, but increase daily sledging distance.

* According to Captain Scott's general scheme, 1 man required ¼ of the unit per sledging week.

every two weeks, one party was returning (including the Pole) and food/fuel depôts were established.

Let us look at the Fifth Man situation. I am *not* interested here in personal reasons for why Lt Bowers was added to the final party. I am interested to account and describe Captain Scott's sledging plan to compensate for Lt Bowers' addition.

Captain Scott's Fifth Man Plan is clearly described in Tab. 11.6. The Fifth Man Scenario, where the difference between Four/Fifth Man Plan is underlined by different shades of gray, from point 4 onward. With either scenario, one is selecting a specific number of rations to remain constant, and the *initial* (before parting) amount of food/fuel at Three Degree (3°) Depôt (see Tab. 9.1) where the Second Return Party parted was 8 units.

These 8 units were intended for the Second Return Party and the Main South Pole party. That was the moment for Captain Scott to make a final decision as who and how many comrades will sledge with him to the Pole. By having 8 people at this location, Captain Scott ensured that the fittest (physically, psychologically and by the representation of Britishness) party would proceed. All options were open; from a two

to a five-man party. These options resulted from general heath conditions as well as with the amount of food/fuel sledged to this location. It appears that everybody was eager to go.

If Captain Scott selected a four-man party to continue to the Pole, he would send off the Second Return Party with 2 units, depôt 2 units for his own return to the Upper Glacier Depôt and take 4 units to go and return from the Pole. Pure and simple.

However, Captain Scott selected a 5th man to sledge to the Pole. Therefore he allotted:

1. 1½ unit for Second Return Party (3 men)[84],
2. 1 unit was depôted for his returning party (5 men) to get them to the Upper Glacier Depôt,
3. 2½ + 2½ + ½ units to and back from the Pole.

The allotted 1½ units to the Second Return Party was a full ration (144-days schedule) to get them to the Upper Glacier Depôt where the next full 1½ unit was depôted. With 6½ units at Captain Scott's disposal, he was *short of 1 unit* to get his party of 5 men to and from the Pole to the Upper Glacier Depôt. Within the 144-days schedule, 1 unit for a 5-man party translates to about 5½ sledging days. It meant that by adding the Fifth Man, Captain Scott greatly changed his plans and if he continued to follow the 144-days schedule, he and his party would have been short of 1 unit (5½ sledging days) of food/fuel. Because no weather related contingency was added to these figures by Captain Scott, one might think that indeed it was a death sentence to the party by adding the Fifth Man.

Interestingly, no one, Captain Scott, Dr Wilson, Lt Bowers, and for that matter Captain Evans or Cherry-Garrard, accounted for this obvious food/fuel shortage. The lack of reflection in Lt Bowers' journal is intriguing, especially if one remembers that he was the expedition's "logistics man". I admit that I was, contrary to the explorers themselves, very much troubled by the figure that Captain Scott was short of food/fuel for 5½ sledging days. Although I had already an explanation, the shortage of food/fuel of 5½ sledging days was imposing. It prompted me to re-read one more time their respective journals (accounts). Captain Evans, in addition to reprinting the orders to Dr Simpson and Meares as discussed in Chapter 10, added some interesting and at first extremely odd comments[85]

> On 4th January we took four days' provision for three men [*sic*] and handed over the rest of our load to Scott,

and on Jan. 14th

> We hauled our sledge for six hours until we reached the Upper Glacier Depot under Mount Darwin. Here we took 3½ days' [*sic*] stores as arranged, and after sorting up and repacking the depot had lunch and away down the Glacier.

It will remain unanswered how the then Lt Evans sledged on 4 days provisions the distance of 146 miles to Upper Glacier Depôt and about 103 miles to the Lower Glacier Depôt on 3½ days provisions. Originally, 2 units (2 weeks' provisions for 4 men) were left at the Upper Glacier Depôt for each returning party. It meant 14 days provisions for a 3-man party. Altogether, it was 1½ out of 2 units allotted for the Second Return Party (3 men).

For that reason, Captain Evans' account of the Second Return Party's food/fuel rations is simply erroneous, and it appears that there is no way to find the actual values. Despite that, his accounts are telling. He was concerned with food/fuel rations.

But not only that: Captain Evans' account also hints that the division of food/fuel rations at the moment of parting from the Captain Scott (5 men) and Second Return (3 men) parties was *different* than the division resulting from the 144-days schedule. At that moment, by adding the Fifth Man to sledge to the Pole, an extra food/fuel for 1 man and about 1 month of sledging had to be allotted until the parties reached the Upper Glacier Depôt.

I think, and will argue in what is to follow, that to compensate for the Fifth Man being taken to the Pole, Captain Scott made several *mutatis mutandis* decisions:

1. Reduce allotted planned food/fuel according to 144-days schedule to the Second Return Party,
2. Ask the Second Return Party to proportionally increase their sledging daily velocity (distance),
3. Depôt at 1½° (88°29′S) Depôt extra food/fuel obtained from the surplus of the Second Returning party, pending point 1 above,
4. Increase the South Pole party's velocity to conceal the effect of the Fifth Man.

At this moment, the investigative reader may recall the discussion presented in Chapter 2, and in particular Fig. 2.3. It was shown there that all the parties while on the homeward leg were sledging much faster than during the inward part of the journey. I attributed this change to the poorly if at all defined "homeward effect". Later, in Chapter 9, I looked at the sledging velocities of all parties in terms of the fraction of days relative to the 144-days schedule (Figs. 9.1, 9.3 and 9.4). I stress here that these plots and analyses were pertinent to the original assumed and logistically implemented 144-days schedule.

Indeed, the required change of sledging velocity, described above, was implemented by the Second Return Party, and Captain Evans remarked[86]

> After the first day's homeward march I realised that the nine hours' marching day was insufficient. We had to make average daily marches of 17 miles [*sic*] in order to remain on full provisions whilst returning over that featureless snow-capped plateau.

Since the distance from parting with the Captain Scott team and the Upper Glacier Depôt was about 146 miles, Captain Evans' 17 miles gives about 8½ sledging days instead of 14½ according to the 144-days schedule to be on "full provisions". Thus after a little calculation[87] one can determine that the Second Return Party was carrying about $^{9}/_{10}$ of a unit. For simplicity, I assumed that it was indeed just 1 unit instead of 1½ if they sledged according to the 144-days schedule.

It appears that an extra ½ unit was left at the depôt for Captain Scott's party use. Returning to the above calculations of the 144-days scheme of Captain Scott's South Pole party (5 men), let me recall that if the party followed that scheme, the party would have been short of 1 unit to return to Upper Glacier Depôt. Now we know that indeed the party was short of 1 – ½ = ½ of a ration. Provided that the party, like the Second Return Party, could increase its sledging velocity to account for the lack of ½ ration, the new plan was just perfect and workable.

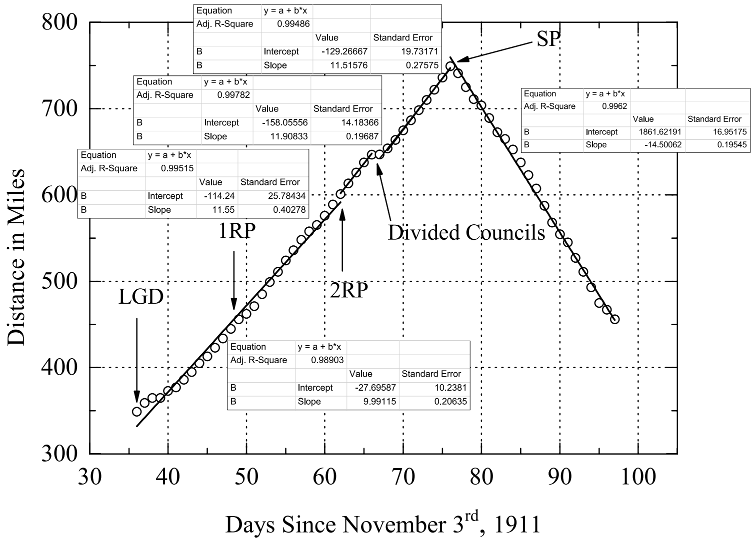


Figure 11.14. The plot of distance (○) sledged by the Captain Scott party from the Lower Glacier Depôt. The black arrows indicate the following: LGD – Lower Glacier Depôt, 1RP – First Return Party, 2RP – Second Return Party and SP – the South Pole being reached. The black arrow indicates "Divided Councils" when Captain Scott ordered his final party to depôt skis and then ordered them to return and continue ski sledging. More on that in the main text. The black solid lines represent a linear fit of the equation: y(distance in miles) = a + bx(days) to Captain Scott's recorded data (○). Respective fitting parameters are given in rectangles. The sledged velocities for given periods are as follows: *First period* from Lower Glacier Depôt until parting of the Second Return Party $\upsilon = 10.2 \pm 0.4$ miles/day, *Second period* until Divided Councils $\upsilon = 11.6 \pm 0.4$ miles/day, the *Third period* until the South Pole $\upsilon = 11.9 \pm 0.2$ miles/day and $\upsilon = 11.5 \pm 0.2$ miles/day and the *Last period* until Upper Glacier Depôt $\upsilon = 14.5 \pm 0.2$ miles/day.

Indeed, Captain Scott's rearrangement of plans, including taking the Fifth Man to the Pole and making sure that the Second Return Party and his own party would have full rations while sledging back, was a *logistical masterpiece*.

One can only appreciate Captain Scott's honesty and self-criticism when working out his Fifth Man plan to perfection. On Jan. 5th, he acknowledged that[88]

> Cooking for five takes a seriously longer time than cooking for four; perhaps half an hour on the whole day. It is an item I had not considered when re-organising.

Let me support the above calculations of allotted rations by using a more detailed analysis of the sledging velocity of the Captain Scott party during the Antarctic Plateau stage. The results are clearly depicted on Fig. 11.14. From this figure, one can clearly notice that right after the Second Return Party parted, the Captain Scott party increased its sledging velocity from $\upsilon = 10 \pm 0.2$ to $\upsilon = 11.6 \pm 0.4$ miles/day. On Jan. 6th–7th the party crossed difficult surfaces and even

> decided to leave our ski on account of the sastrugi. This morning we marched out a mile in 40 min. and the sastrugi gradually disappeared. I kept debating

> the ski question and at this point stopped, and after discussion we went back and fetched the ski.

On Fig. 11.14, I denoted this moment as "Divided Councils" when the party significantly slowed its progress. From Jan. 8th until the Pole, Captain Scott's party sledged with a fine velocity of $\upsilon = 11.9 \pm 0.2$ miles/day or $\upsilon = 11.5 \pm 0.2$ miles/day. At the Pole, Captain Scott spent less time than Captain Amundsen's party and turned back. It was not due to lost priority, but due to the new five-man sledging plan. During the outward leg, as indicated on Fig. 11.14, the Captain Scott party was sledging with a velocity of $\upsilon = 14.5 \pm 0.2$ miles/day.

In summary, one can see that the Fifth Man issue was pointlessly raised by many authors who – without careful analysis as presented above – speculated on the issue. Contrary to these authors' myopic accounts, Captain Scott cut a fine plan and implementation, and he was able to safely put five Britons on the South Pole instead of four.

⋮

Let us look at the sledging performance of the final Captain Scott party. Fig. 11.15 depicts this party's performance measured as a fraction of sledging days relative to the 144-days schedule. On the 63rd sledging day (Jan. 4th, 1912), after Captain Scott was in his mind assured that the sledging party of 5 men would perform as expected, the Second Return Party parted. For the next two days, Captain Scott's party continued its march toward the Pole and reduced the lag behind the schedule.

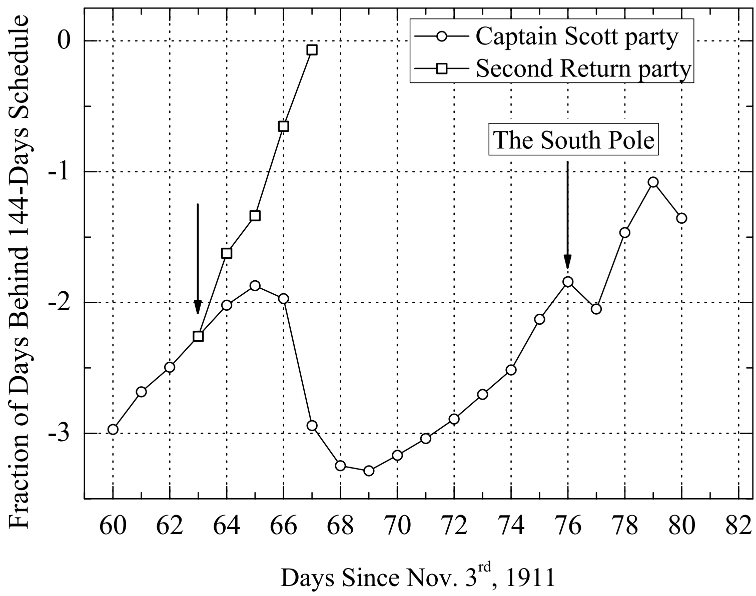


Figure 11.15. Fraction of days relative to the 144-days schedule of the Captain Scott party and the Second Return Party during the journey until Captain Scott added Lt Bowers to the final party. And he proved his worth during the final northward leg. Therefore, Captain Scott's addition of Lt Bowers to the final party was a positive and right decision.

However, from the 65th day one can see that the party was slowing down for the next four days. Was it due to the party enlargement?

On Jan. 7th, 1912, something entirely unexpected happened. Captain Scott commented, "Last night we decided to leave our ski on account of the sastrugi." In the morning, after about 40 minutes of on foot sledging the party observed that sastrugi disappeared, and Captain Scott added in his journal

> I kept debating the ski question and at this point stopped, and after discussion we went back and fetched the ski; it cost us 1½ hours nearly.

Since it is evident that the party was clearly appreciating wearing skis while dragging the sledge, this comment immediately raises two questions to the investigative reader. Until Jan. 7th the party sledged on a number of occasions over sastrugi, and nobody suggested to abandon the skis. It was understood and readily experienced that sooner or later the sastrugi disappear. Why on this occasion did the party debate ski usage? A day before, however, Captain Scott had given the answer – "mainly because of risk of [ski – KS] breakage". It will remain unanswered why on the previous occasions, like on Dec. 16th, the parties did not decide to leave the skis despite the fact that "The sledges were so often brought up by this [sastrugi – KS] that we decided to take to our feet, and thus made better progress". However, not long after, the parties returned to ski sledging on New Year's Eve 1911. Captain Scott ordered the Second Return Party to depôt their skis and about 100 ℔ of gear. From this day, the Second Return party sledged south on foot until Jan. 4th when the party turned and sledged northward. Lt Bowers recounted[89]

> They accompanied us for about a mile before returning, to see that all was going well. Our party were on ski with the exception of myself; I first made fast to the central span, but afterwards connected up to the toggle of the sledge, pulling in the centre between the inner ends of Captain Scott's and Dr Wilson's traces. This was found to be the best place, as I had to go my own step.

Did all of this negatively influence sledging performance? On Fig. 11.15, I depicted in a more detailed way the fraction of days behind the 144-days schedule for both parties in the early days of January 1912. It is indeed an interesting figure. One can see that despite the fact that the Second Return Party was sledging on foot, the parties were re-gaining distance lost on previous occasions. But not only that: both parties increased their sledging velocity according to the just implemented Fifth Man sledging plan. After the Second Return Party parted (day 63 on Fig. 11.15), both parties continued their performance. One must therefore conclude, from Fig. 11.15 (days 60–65), that in this setting neither foot sledging nor the Fifth Man negatively influenced sledging efficiency.

Thus, contrary to what was falsely envisioned by many authors,[90] the destructive influence of the inclusion of Lt Bowers in the Captain Scott party is not confirmed. On the contrary, the Captain Scott party was performing better and better. However, at what cost, the investigative reader could ask? I think that Captain Scott proved that during his South Pole trek, dragging the sledge on skis was much more effective and energy saving over dragging the same sledge on foot. Therefore, Lt Bowers certainly needed extra strength to keep up with ski sledges. Lt Bowers was a sturdy fellow. He proved it during the Cape Crozier journey in July 1911.

One more interesting factor, related to the previously discussed Feb. 27th through Mar. 27th, 1912 – *Extreme Cold Snap* (Chapter 7) and Mar. 21st through 29th, 1912

– *Never Ending Gale* (Chapter 8) observations, can be made from Fig. 11.15. On Jan. 8th, 1912 (days 66–67 on Fig. 11.15), both parties were heading in the opposite direction each day with an ever greater distance between them. On this January day, the distance between the parties was about 2° (120 miles), and *both* parties reported a short-lived blizzard event of 5–7 in the Beaufort scale.[91] According to Captain Scott's entry in his journal, it was the first blizzard the party recorded on the Antarctic Plateau. Although Lt Evans did not comment in this way, it was the first blizzard for both parties and it occurred almost simultaneously as far as wind force measurement frequency allows one to say[92]

> They accompanied us for about a mile before returning, to see that all was going well. Our party were on ski with the exception of myself; I first made fast to the central span, but afterwards connected up to the toggle of the sledge, pulling in the centre between the inner ends of Captain Scott's and Dr Wilson's traces. This was found to be the best place, as I had to go my own step.

Thus certain meteorological events, especially those of pronounced strength and/or range, do not occur as local and confined events along Captain Scott's route in Antarctica. The above is an additional observation and an argument supporting the fact that weather events were falsely reported by Captain Scott – the *Extreme Cold Snap* and *Never Ending Gale*. Therefore, the answer to Captain Scott's question written in his journal on Dec. 5th, 1911, during the four days of blizzard

> Is there some widespread atmospheric disturbance which will be felt everywhere in this region as a bad season, or are we merely the victims of exceptional local conditions? If the latter, there is food for thought in picturing our small party struggling against adversity in one place whilst others go smilingly forward in the sunshine. How great may be the element of luck! No foresight no procedure could have prepared us for this state of affairs. Had we been ten times as experienced or certain of our aim we should not have expected such rebuffs.

is yes to the former possibility.

Finally, the investigative reader could readily notice on Fig. 11.15 that during the blizzard event on or about Jan. 8th (days 66–67), the Captain Scott party significantly slowed down while Lt Evans' party was sledging with greater velocity. Indeed, a surprising observation until one consults the weather data in Dr Simpson's third volume and see that *both* parties reported wind direction S by E. Since Captain Scott was sledging southward he literary faced the blizzard, thus making sledging difficult or impossible. It was not the case with Lt Evans' party, which sledged northward and the blizzard blew at their backs. Using a compass to navigate, the Second Return Party was advancing in the desired direction.

In conclusion, the issue of the Fifth Man was overblown by cheap shots aimed at Captain Scott's management of the South Pole parties. Fifth Man-related comments and conjunctures by Sir Ranulph, Huntford, Dr Solomon[93], Crane[94], and Dr Barczewski as mentioned earlier in this subsection are false, unsubstantiated notions. By adding Lt Bowers to the final South Pole party, Captain Scott not only allowed 5 Britons to reach the Pole, but also and most importantly he re-arranged his

logistics plans in the *finest* way possible. The popular wisdom of the Fifth Man issue is not an example of Captain Scott's sloppiness and lack of management skills, as the above authors might say, along with the business management books that have taken up the issue as an example of Captain Scott's bad management. On the contrary, it is an example of sloppy historical accounts from the above-mentioned authors, and a testament to Captain Scott's real logistical skills and outstanding sledging performance of his party during the returning leg on the Antarctic Plateau.

11.1.9. Fuel Leakage

> [*A*] *shortage of fuel in our depôts for which I cannot account, and finally, but for the storm which has fallen on us within 11 miles of the depôt at which we hoped to secure our final supplies. Surely misfortune could scarcely have exceeded this last blow. We arrived within 11 miles of our old One Ton Camp with fuel for one last meal and food for two* [*sic*] *days.*
>
> Robert F. Scott[95]

Although the issue of food and fuel allowances, and respective consumption and use are bound together, I decided to look at them in separate subsections. From my own perspective, I firstly was analyzing logistical aspects of Captain Scott taking the Fifth Man to the Pole. Presented in subsection 11.1.8, are the results showing how Captain Scott, in the most appreciable way, re-arranged the food/fuel rations distribution and managed to increase daily sledging velocity. These calculations led me to make a more detailed analysis of food/fuel rations. First, I accounted for fuel leakage as described in section 9.3 and summarized in subsection 11.1.10. Second, while summing up fuel rations, it becomes evident that despite Captain Scott's references to apparent food shortages, the rations available to his party were adding up nicely. Additionally, I was puzzled by the fact that the Captain Scott party almost entirely ignored the pony cutlets available for them at the Shambles Camp and elsewhere: this will be covered in the next subsection. Since the Captain Scott party sledged light as compared to sledging weights on the way up the Beardmore Glacier, there certainly was considerable room for a number of cutlets.

William Lashly, a member of the Second Return Party and later the search party, reported some fuel leakage. Interestingly, the First Return Party did not report any fuel problems. However, Lashly's and Captain Scott's accounts of this issue were very imprecise. In section 9.2, I was able to figure that the leakage did not exceed about 10% of its volume. If the party of five men consumed 100% of fuel then one man used about 20% of the total fuel amount. Consequently after P. O. Evans' death on Feb. 17th, a surplus of fuel appeared, and the party of four men had about a 10% (20%–10%) relative surplus of fuel compared to a five-man party. Evidently, P. O. Evans' death also resulted in a food surplus.

In Tabs. 11.6, 11.7, 9.2, and 9.3, I compiled a summary of the rations available to the Captain Scott party after they started to descend the Beardmore Glacier from the Upper Glacier Depôt on Feb. 7th, 1912. The conclusions from this food rations audit are rather palpable. The party, with a decreased number of men resulting from

P. O. Evans' and Captain Oates' deaths, was in possession of *full* food and fuel rations at least until Mar. 27th, 1912. This date was obtained under the assumption of the planned 144-days schedule usage of daily allowances of food/fuel and from the sum of sledging rations available to the varying (diminishing) number of sledges. Therefore, the Captain Scott party on Mar. 9th, 1912, right after arriving at the Upper Barrier Depôt was in easy reach of One Ton Depôt.

However, by Mar. 9th, 1912, according to Captain Scott, *all elements* were against them. The disaster was in full swing:

- fuel leakage,
- food shortage,
- *Extreme Cold Snap*,

and approaching:

- *Super Extreme Cold Snap* of –70°F,
- *Never Ending Gale*.

While looking at Captain Scott's daily minimum temperature data, I used a highly sophisticated analytical method to prove that he fabricated the *Extreme Cold Snap*. In a way it was, from Captain Scott's point of view, a "sophisticated" hard to detect (confirm) temperature data fabrication. Indeed, it was impossible to detect until the data was available from automated weather stations, and the predictive power of neural networks could be used to find insight into the question. The above required certain analytical skills. However, in the case of food and fuel fabricated shortages, simple math was sufficient to expose Captain Scott's trumped-up story.

In the case of temperature and wind data, Captain Scott might have thought that it would be virtually impossible to discover his fabrications. But in the case of food rations, could he expect that simple mathematics would not be sufficient to detect his forgery? Indeed, it is very confusing for the author and I presume for the investigative reader too.

11.1.10. Food Shortages on the Barrier

> [*March 29th*] *We had fuel to make two cups of tea apiece and bare food for two days on the 20th* [*sic*] … *We shall stick it out to the end, but we are getting weaker, of course, and the end cannot be far.*
>
> Robert F. Scott[96]

> *Once you eliminate the impossible, whatever remains, no matter how improbable, must be the truth.*
>
> Arthur Conan Doyle[97]

In Chapter 9, I investigated the related food, fuel and depôt issues. In particular, in section 9.3, I analyzed food/fuel shortages reported by Captain Scott at the beginning of February 1912 (see Tabs. 9.2 and 9.3). The careful analysis presented there shows that the returning party did not experience food shortages as referred to by Captain Scott. I have in the same chapter also looked at fuel leakage reported by Captain

Scott, and others. One more time, it was shown that the recorded leakage did not exceed 10% of the volume. This leakage was indeed unfortunate, and it was possible that 10% of the much-needed volume of fuel leaked and evaporated. However, despite the resulting discomfort because of the leak, one cannot seriously postulate that this fuel shortage led to the Captain Scott party's final disaster.

According to the analysis presented in section 9.4, Captain Scott and I presumed that by taking the Fifth Man to the South Pole, they were obliged to make logistical re-arrangements of food/fuel rations, as well as increasing sledging velocity to compensate for the additional man. All of these changes were nicely and precisely introduced and executed, and all parties returned on full rations to the Shambles Camp/Lower Glacier Depôt on Feb. 16th/17th, 1912. P. O. Evans' death on Feb. 17th, 1912 did not occur due to lack of food, though he possibly could have been in want of food.

Upon arriving at Shambles Camp/Lower Glacier Depôt, something extraordinary happened. The Captain Scott party, in addition to the full food/fuel[98] rations depôted along the return route, found an abundance of food – pony cutlets stored in December 1911. The presence of pony cutlets at Shambles Camp was obviously not surprising. What is startling is that Captain Scott and his party, casually and bordering on negligence, did not take all of the pony cutlets. Although Captain Scott clearly acknowledged that

> [Sunday, Feb. 18th.] Here [Shambles Camp] with plenty of horsemeat we have had a fine supper, to be followed by others such, and so continue a more plentiful era if we can keep good marches up. New life seems to come with greater food almost immediately, but I am anxious about the Barrier surfaces.

in the following days he took relatively little advantage of pony cutlets. We do not know the exact numbers or how many pounds of cutlets were obtained from the ponies, however, using a conservative estimation (see section 9.4), one can figure that these cutlets alone would have been sufficient to feed the Captain Scott party until One Ton Depôt was reached. The weight of the pony varies from 400–800 ℔ and if about 10% of this pony mass was transferred into pony cutlets it would give 40–80 ℔ from one pony. Since five ponies were shot at Shambles Camp, this yields 200–400 ℔ of cutlets. If one person was daily consuming 2 ℔ of these cutlets, then the pony meat depôted at Shambles Camp would have been sufficient for (200 – 400)/2 = 100 – 200 days for one man. And because Captain Scott sledged from this camp in a 4-man team, it would translate into 25–50 sledging days. Taking a middle value of this estimation, one must conclude that the pony cutlets from Shambles Camp could have fully supported Captain Scott's party food intake for well over a month of sledging. Yet Captain Scott only refers to eating pony meat from Feb. 18th through Feb. 28th.

Since the distance from Shambles Camp to Hut Point is about 349 miles, the pony cutlets would have been sufficient to feed the party all the way back. In a similar fashion, the distance between Shambles Camp and One Ton Depôt is 231 miles; Captain Scott's party could have easily reached it sledging exclusively on rations of pony cutlets.

Provided that the first pony (Jehu) was shot on Nov. 24th, 1911 (–81.23333) and that this location was reached by the returning Captain Scott party on Mar. 3rd/4th, 1912 the possibility of reaching One Ton Depôt and feeding on pony cutlets becomes a certainty. Let me stress here that the above is valid *without* the party's use of food originally depôted on the Barrier.

None of the above happened, and Captain Scott's party used made very little use of the pony cutlets. The investigative reader may provide the following to explain the Captain Scott party's lack of interest in consuming pony cutlets:

- the cutlets were rotten due to high temperatures,
- it was impossible to dig out the cutlets because they froze into one unmanageable mass,
- the sledge was overloaded (too heavy),
- fuel shortage did not permit cooking the pony cutlets,
- the party was not in want of food.

Without special analysis, one must conclude that none of the above are valid. If they were valid, Captain Scott would have expressed his disappointment of not being able to use cutlets as additional food, as well as a possible source of vitamin C (see subsection 11.1.12). Therefore, the limited use of pony cutlets by the Captain Scott party seemingly remains a mystery.

Before addressing the main result of this subsection, let me briefly turn to Captain Scott's journal where he vividly reported

> [Mar. 18th] My right foot has gone, nearly all the toes two days ago I was proud possessor of best feet … We have the last half fill of oil in our primus and a very small quantity of spirit this alone between us and thirst.
>
> [Mar. 19th] Lunch. We camped with difficulty last night, and were dreadfully cold till after our supper of cold pemmican and biscuit and a half a pannikin of cocoa cooked over the spirit … We have two days' food but barely a day's fuel. All our feet are getting bad Wilson's best, my right foot worst, left all right. There is no chance to nurse one's feet till we can get hot food into us. Amputation is the least I can hope for now, but will the trouble spread?
>
> [Mar. 29th] Since the 21st we have had a continuous gale from W.S.W and S.W. We had fuel to make two cups of tea apiece and bare food for two days on the 20th … We shall stick it out to the end, but we are getting weaker, of course, and the end cannot be far.

On Mar. 18th the Captain Scott party had already sledged for 1358 miles (see section 10.6), and according to Captain Scott had experienced food shortages, fuel shortages, and the *Extreme Cold Snap*. On the same day, Captain Scott reports in their possession a "half fill of oil", a "very small quantity of spirit" and that his "right foot has gone". In spite of that, as one may conclude from these journal entries that Captain Scott, Dr Wilson, and Lt Bowers remained alive at least until Mar. 29th.

Is it *feasible* that Captain Scott's dog-tired party, moving at half speed, and with an ever-falling original sledging velocity, was somehow able to survive without food/fuel for ten or so long days? Is it actually possible that anyone could survive without food in Captain Scott's *Extreme Cold Snap* from Mar. 18th through Mar. 29th, when temperatures were according to Captain Scott –40°F, and at one occasion –70°F (–57°C) (see Fig. 7.8)?

Recalling that at a number of occasions Captain Scott was anxious even about the possibility of a one-day food/fuel shortage, one must arrive at the conclusion that *no one* from the Captain Scott party could have possibly survived about ten days without

food/fuel in every day/night temperatures of –40°F. Although I cannot prove it, I am certain that even a fully physically and mentally fit man, being able to protect himself with the protection available to Captain Scott at the end of March, and temperatures of –40°F would not survive for 9 days.

So, what is incorrect with Captain Scott's account? To find an answer, let us look carefully at Captain Scott's food/fuel rations during the Barrier leg of his return journey. The result is clearly depicted on Fig. 11.16. Indeed, it is an interesting and telling figure. The analysis of this figure must be split into three distinct time periods, marked by the deaths of P. O. Evans and Captain Oates:

- The *First Time Period* lasts until the death of P. O. Evans on Feb. 17th, 1912, when Captain Scott's five-man party sledged on *full* food/fuel rations down the Beardmore Glacier,
- The *Second Time Period* lasts until the death of Captain Oates on Mar. 17th, 1912, when Captain Scott's four man party sledged on full food/fuel daily rations across the Barrier. Due to P. O. Evans' death, on each sledging day the party was "saving" his one daily food/fuel ration,
- The *Third Time Interval Period* lasts until Mar. 27th, 1912 when Captain Scott's three man party would have consumed the last *full* [*sic*] food/fuel daily ration.

Obviously, the above conclusions as well as Fig. 11.16 are in accordance with the previous analysis of food/fuel rations of the Captain Scott party sledging over the Antarctic Plateau, as presented in section 9.4.

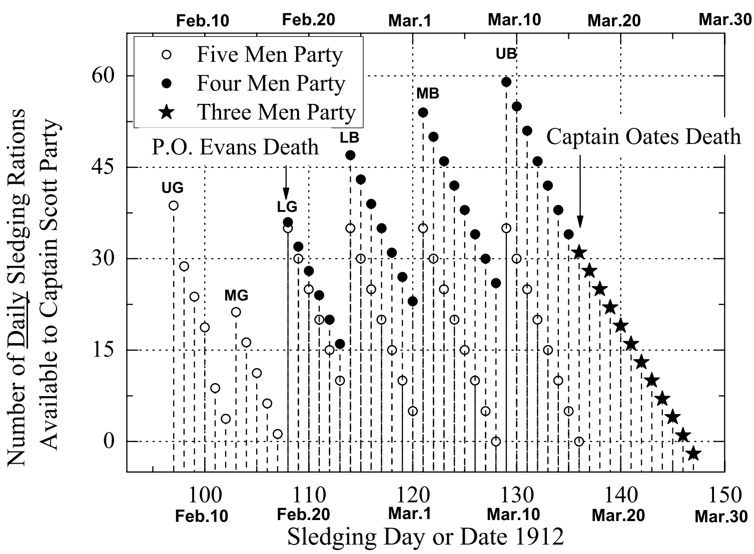


Figure 11.16. The number of daily sledging rations available to the Captain Scott party during the Beardmore and the Barrier stages. The circles (○) represent the number of rations available to the Captain Scott party *as if* it was sledged with a five (5)-man party. The black dots (●) and black stars (★) represent the *actual* number of daily sledging rations available to the Captain Scott party after P. O. Evans' death on Feb. 17th (four man party), and after Captain Oates' death on Mar. 17th (three man party), respectively.

Based on the combined results from the current chapter and the 9.4 subsections, one must conclude that Captain Scott's party sledged on *full* food/fuel daily rations:

- Over the Antarctic Plateau with increased sledging velocity, to catch up with food/fuel rations used by the Fifth Man (Lt Bowers),
- Although after reaching the Beardmore Glacier the party was gradually and systematically decreasing its sledging velocity, the party was sledging on full rations,
- Over the Barrier, with ever decreasing sledging velocity, and due to the deaths of P. O. Evans and later Captain Oates, the Captain Scott party had full food/fuel daily rations until at least Mar. 27th, 1912.

These staggering conclusions indeed explain the above question about the feasibility of how long the party could last on the Barrier without food/fuel, when on Mar. 19th Captain Scott noted, "We have two days' food but barely a day's fuel". Apparently Captain Scott was alive on Mar. 29th, 1912.

Although the Captain Scott party was not moving on Mar. 19th, 1912, it was the 138th sledging day and the party was in possession of 25 daily man food/fuel rations (see Fig. 11.16). If Captain Scott was "sledging" as a five-man party and if he was, on Mar. 19th, at the same location, as he was originally then his party would be short of 3 days $\times$ 5 men = 15 food/fuel daily rations. Given that my calculations of daily rations were done in terms of integer numbers, the actual sum of rations can be attributed to {given day $\pm$ day}. Thus on Mar. 19th and in the five-man scenario, the Captain Scott party would have been short of (2 to 4) days $\times$ 5 men = 10 to 20 daily rations. Interestingly, the lower bound of this estimation (2 days' food) agrees exactly with Captain Scott's remark in his journal. It shows that Captain Scott was giving his account in terms of a five-man party, and its regular daily food/fuel consumption. However, we know and Captain Scott knew that it was not the case.

The food/fuel allotted to P. O. Evans and Captain Oates evaporated, according to the Captain Scott. However, this is not the only time when Captain Scott is attempting to lead us astray. The investigative reader may recall at this moment one of the weather events, Mar. 21st through 29th, 1912 – *Never Ending Gale* (see Chapter 8), which according to Captain Scott prevented his party from reaching the One Ton Depôt, and thus led to the final disaster. The most *intriguing* part of inventing the *Never Ending Gale* is the reason why it was invented. Were the inventions of the *Extreme Cold Snap* and *Super Extreme Cold Snap* not enough? Apparently they were not, as it began about Mar. 21st and supposedly lasted until Mar. 29th.

Although Captain Scott's food/fuel account during March is highly imprecise, he evidently felt obliged to cover up the possibility that someone would recalculate his party's food/fuel rations during the Barrier stage as I did in the current subsection. The result of these simple calculations is that the party had *full* food/fuel rations until *Mar. 27th*. Thus, after the *Extreme Cold Snap* somehow ended, the question would arise: why, when having food/fuel did Captain Scott's party not sledge down to One Ton Depôt and from there to Hut Point? A good question indeed. To answer this question, or better yet to dismiss the possibility of even asking the question, Captain Scott invented the Mar. 21st through 29th, 1912 *Never Ending Gale*. Therefore, if a properly addressed question of why despite having sufficient food/fuel rations, the party did not move, the *Never Ending Gale* was at hand.

In summary, as it is evident from simple math, the Captain Scott party had full food/fuel rations at least until Mar. 27th, 1912. The "additional" rations resulted from the rations originally allotted to – and later not consumed by – P. O. Evans and Captain Oates. Additionally, Captain Scott deliberately neglected pony cutlets depôted at Shambles Camp and several other places on their return route.

11.1.11. Collecting and Hauling Geological Specimens

A lie gets halfway around the world before the truth has a chance to get its pants on.

Jonathan Swift[99]

The eternal belief of lovers and poets in the power of love which is more enduring that death, the finis vitae sed non amoris that has pursued us through the centuries is a lie. But this lie is not ridiculous, it's simply futile.

Stanisław Lem[100]

In section 9.3, I already discussed in detail how and when the Captain Scott party decided to stop and collect about 35 ℔ of various specimens during the descent of the Beardmore Glacier. During various events to celebrate the centennial of Captain Scott's South Pole expedition, the fact that geological specimens had been collected and dragged to the very end was used to portray Captain Scott and his comrades as martyrs of science. Of course, this was not a new theme and it was present from the time of the first accounts of Captain Scott's *South Pole Journey* and subsequent disaster.

The past and present rhetoric was that if Captain Scott did not have a noble passion for science and knowledge he and his party would not perish while hauling geological specimens:

> … laid down their lives in the pursuit of geographical knowledge[101]
>
> … heroes who laid down their lives in the cause of science[102]
>
> This devotion to science may well have meant the difference between life and death to them.[103]
>
> … no evidence could have shown more plainly the devoted manner in which he and his companions carried out this intention than did this collection of fossils which they had refused to jettison even when life itself was at stake.[104]
>
> … or Scott collecting geological samples on the way back when they are desperate to get home, these things make real heroes, much bigger than movie stars or athletes.[105]
>
> … scientists to the end[106]
>
> Of course, a Norwegian team led by Roald Amundsen reached the pole first. And Scott and his team never returned home, dying of starvation and exposure on the return journey.

> But alongside their bodies were several pounds of their precious geological samples and scientific notebooks which, even while approaching death through exhaustion, Scott and his men continued to take with them.
>
> Those samples and data are the enduring legacy of the *Terra Nova* expedition.[107]

The message is indeed simple; a stack of rocks (specimens) secured the disaster as a noble sacrifice for science. Did Captain Scott ever say that? Of course he did not. However, his message was apparently well understood by many writers as cited above, and by a great number of authors not mentioned here. It was Dr Atkinson who led Captain Scott's search party in the early Antarctica summer of 1912, and after finding their tent he recorded[108]

> We recovered all their gear and dug out the sledge with their belongings on it. Amongst these were 35 lbs. of very important [*sic*] geological specimens which had been collected on the moraines of the Beardmore Glacier; at Doctor Wilson's request they had stuck to these up to the very end, even when disaster stared them [*sic*] in the face and they knew that the specimens were so much weight added to what they had to pull.

Before commenting on the above remark, let me recall the results presented in section 9.3 where the issues of Captain Scott's food alleged shortages and specimen collection were discussed in detail. The following options for dealing with specimens in Captain Scott's party have been discussed:

- Not stop and not geologize,
- Implement scenario I (stop and geologize, haul and examine the specimens, make drawings of the most interesting ones and store at a defined location while carrying a note with them detailing the defined location and requesting the specimens to be retrieved),
- Implement scenario II (stop and geologize during the Beardmore ascent on Dec. 21st – 22nd, 1911),
- Implement scenario III (stop and geologize during the Beardmore descent and haul specimens in relays to Hut Point),
- In conjunction with scenario, I, II and partly III implement the scenario adopted by Lt Shackleton previously to his specimens,
- Depôt specimens at the foot of the Beardmore Glacier (say Shambles Camp) for Meares to pick them up upon his arrival.

We know that Captain Scott did not analyze, discuss, or implement the possible scenarios above to contain the impact of geologizing with the primary obligations of *saving* his party and continuously sledging forward to Hut Point.

The above possibilities were not only unanalyzed by Captain Scott, but were not investigated by the previous fairytales. Literally one specimen of minute weight with a fine fossil imprint would suffice for science. But even without this small fossil imprint, Dr Wilson's talented hand would presumably meet scientific requirements of proving that plant fossils were present in what we now call Antarctica. The actual weight of Dr Wilson's drawing was nothing, but its (potential) scientific impact was enormous. Since Dr Wilson was a gifted observer, he could with ease draw with

sufficient detail to determine differences between specimens. It appeared to the party that Captain Scott's specimens contained only a few fossil imprints. This alone could, if sensible reason prevailed, further reduce the number of specimens and/or drawings.

None of the above happened, and the party was hauling 35 ℔ of rocks. All for a "good" reason. The reason was eagerly picked up by various people, starting with the Daily Mirror and Dr Atkinson, who concluded that Captain Scott and his party "laid down their lives in the pursuit of geographical knowledge". It is precisely how Captain Scott set up the whole geologizing issue.

One more time, Captain Scott triumphed in the public's eyes. He flawlessly changed the paradigm from assaulting the South Pole to really going for science and discovery. His death did not matter, compared with the specimens collected and their unknown value to science. The value to science of these specimens was indeed small, if any value at all (see section 9.3 for arguments). But it did not matter for many. The pointless hauling of 35 ℔ of rocks became a statue by itself: "while approaching death through exhaustion, Scott and his men continued to take [specimens] with them." This particular sentence was written in 2012 by Pallab Ghosh,[109] whose comment echoed the typical journalist's original 1913 accounts. One might expect a more educated description from people with a proven knowledge of polar exploration, like Sir Clements Markham. However, his "debriefing" of Captain Scott's expedition fell short on all counts, and he only reinforced the previously unfounded and pathetic conjunctures[110]

> On Sunday March 21st they were only eleven miles from One-ton Depôt, getting more and more unequal to the work. Yet they had brought the great extra weight of 35 lb. of fossils all the way, a monument to the heroism of the gallant discoverers …
>
> To crown all, Captain Scott and Dr Wilson made a large collection of the fossil flora which established the geological period of the rock formation. These fossils weighed 35 lb., but though worn out, and with strength failing fast, the gallant explorers would not leave them, but dragged these records, until they died. There is no more glorious and more touching event in the whole range of polar history.

Sir Clements, however, was not a novice in interpersonal games, and he was a pragmatic observer of human traits. After all, he was for many years an Honorary Secretary of and then President of the Royal Geographical Society. However, Sir Clements, as well as the previous and the future commentators, produced fallacious notions that the specimens were found because "the gallant explorers would not leave them, but dragged these records, until they died".

The truth is precisely the opposite. Because Captain Scott failed to return to Hut Point and instead led his comrades to death, he also jeopardized the other results of his journey: journals, specimens and meteorological data. The fact that Captain Scott's tent would be found by Dr Atkinson's search party was unknown/uncertain to Captain Scott. Therefore, it was rationally pointless for Captain Scott to haul these rocks to ensure that these specimens would be found by the search party. If he were rational, and thinking about saving his and his comrades lives, Captain Scott should have seriously considered the above scenarios, which included depôt the specimens at Shambles Camp. As a precaution, he should have made a note ordering any possible search party (and/or Meares) to sledge to Shambles Camp to collect the specimens.

This scenario was perfectly sound from Captain Scott's perspective as well as with *post factum* knowledge. Such a scenario would sensibly account for Captain Scott's fight to save lives and possibly contribute to science if he had such a desire.

However, Captain Scott, Dr Wilson, and Lt Bowers were not looking at differently educated options. They preferred hauling 35 ℔ of rocks to redeem themselves for coming in second at "an awful place and terrible enough for us to have labored to it without the reward of priority". But not only that, they hauled these specimens to redeem themselves to their countrymen back home. In subsection 11.1.13, we will see testimony from an experienced outside observer on just how feasible Scenario I was.

Returning to the principal question of this subsection, one has to observe that during their return from the Pole, Captain Scott's party was reaching depôts at minimal sledge weight, meaning that the maximum sledging load was right after the party loaded new provisions at the next depôt. Therefore, the 35 ℔ weight of specimens was proportionally an increasing burden as distance to the next depot decreased.

It appears that despite the obvious motivation and justification to sledge as fast and as light as possible – all the depôts on the Barrier were set up for this purpose – Captain Scott disregarded this notion. Captain Scott's action was "supported" by Cherry-Garrard, who as I discussed in much more detail in subsection 3.1.2, produced high school physics nonsense by commenting that "the friction surfaces of the snow on the runners mattered and not the dead weight [*sic*], which in this case was almost negligible."[111] The dead weight of the sledge in a *fundamental* way matters (see subsection 3.1.2), and for that reason Captain Scott used ponies to haul sledges/provisions during the first Barrier stage.

Captain Scott not only hauled the specimens to the very end, but also as Captain Scott's Norwegian ski expert Tryggve Gran noted after finding the Captain Scott party[112]

> It was incredible how much they had crowded on the sledge. Apart from the geological specimens which weighed about 20 kg, there were masses of empty sacks and tattered clothing. I think they could have saved themselves the weight.

The additional weight of specimens and the weight of the tattered sacks/clothing obviously consumed the diminishing Captain Scott party's energy, which was needed to haul the sledge. However, despite all of the reasons observed before by the party, in February and March 1912 Captain Scott, Dr Wilson, and Lt Bowers were not concerned with them. This alone raises doubts concerning the veracity of the reasons behind collecting and hauling specimens by Captain Scott's party.

It is not particularly surprising that in general simplistic writings, the issue of collecting and dragging the additional load of 35 ℔ of rocks to the end by Captain Scott's party was misrepresented and left unscrutinized, as described above. However, could "cool headed" scientists join these uneducated laments about "heroes who laid down their lives in the cause of science"? The answer is positive in at least one, memorable case. It belongs to the modern rhetoric of portraying the Captain Scott party as martyrs of science. Here is how Dr John A. Long from Flinders University, Adelaide, Australia describes his feelings about the "intangible value" of rocks collected by the Captain Scott party[113]

> These iconic fossils are now housed in the Natural History Museum, London. They symbolize fervor and endeavor in the heart of humanity's quest for

> knowledge against all odds [*sic*], from the heroic age of Antarctic exploration, found in the same [*sic*] tent with the dead bodies of Scott, Wilson and Bowers and, as such, are truly prime examples of museum specimens rich in intangible values.

Since the Natural History Museum in London holds over 70 million specimens, the degree of fuzziness of Dr Long's explicandum is enormous. How many specimens from the collection "symbolize … humanity's quest for knowledge against all [*sic*] odds"? Does Western civilization impose a categorical imperative of "humanity's quest for knowledge against all odds"? Does such a quest *belong* to the scientific method? Is overriding the human instinct of self-preservation for the sake of the quest for knowledge actually rooted in human behavior?

On all counts, the answer is negative. No piece of knowledge or fossil specimen is greater in value than life and self-preservation. While preaching science one, including Dr Long, *must* observe that the elements of the scientific method and models of scientific inquiry are not "against all odds," and more specifically do not require sacrificing human (and animal) life for the smallest or greatest chunk of knowledge. Advocating for the sacrifice of life to gain knowledge recalls the darkest events in history.

Evidently, for a paleontologist like Dr Long, dragging from the field to civilization the piles of rocks at all costs and against all odds adds to knowledge, and enriches these rocks with intangible values. For more on that from the perspective of the *Antarctic Manual* – a research manual for the *Discovery Expedition* – see section 12.4 and *Event 4*.

11.1.12. Vitamin Deficiency

> *The person most likely to know exactly why the three men died was the naval surgeon who eight months later found their bodies, Atkinson. He stated unequivocally that none of the bodies showed visible signs of scurvy.*
>
> Sir Ranulph Fiennes[114]

> *Teddy Evans, the only recorded scurvy sufferer on the Terra Nova expedition, had avoided eating the fresh meat recommended by Wilson, and this omission in his diet quite possibly triggered his condition (May 2012: 2–6): Scott, Wilson and Bowers certainly would not have neglected their diet as Evans had.*
>
> Karen May and George Lewis[115]

> *The onset of scurvy varies from one individual to another and depends in part upon the body's reserves.*
>
> Susan Solomon[116]

A long debate has ensued about the relationship between scurvy and Captain Scott's *South Pole Journey*. This subsection has two components. The first one is a historical

one and directly related to the actual knowledge that affected Captain Scott and his expedition members' actions. The second one is related to the historical scrutiny of the first component by many authors. In relation to the first component, one has to observe that it contains two sub-components: results of scientific investigations of scurvy, and practical knowledge resulting in combating scurvy in many fields of human life, including the exploration of seas and Polar Regions.

The story of scurvy has been eloquently told many times. Since the issue of vitamin C and its deficiency/excess have been studied and reviewed in many publications, I will not repeat these accounts, and will only look at the possibility of vitamin deficiency as a cause of Captain Scott's disaster.

Equally eloquent stories of scurvy in relation to Captain Scott's *Terra Nova Expedition* and in particular to his *South Pole Journey* have been written. However, linguistic eloquence has nothing to do with the accuracy of the presentation of facts and knowledgeable accounts. Once again, within the historical accounts of Captain Scott's expedition we are coming across monumental nonsense and straightforward foolhardiness.

Recently, Karen May published her findings in an article titled "Could Captain Scott have been saved? Revisiting Scott's last Expedition". In this article, which was published and apparently peer-reviewed by the peer-reviewed journal of the Scott Polar Research Institute, *Polar Record*, Karen May clearly defines one of her objectives[117]

> For this article I will narrow the parameters to one specific question: if all the men had the same diet, why did Evans succumb to scurvy when his companions did not?

Later she arrives at the enlightening conclusion that[118]

> Teddy Evans, the only recorded scurvy sufferer on the *Terra Nova* expedition, had avoided eating the fresh meat recommended by Wilson, and this omission [*sic*] in his diet quite possibly triggered his condition (May 2012: 2–6): Scott, Wilson and Bowers certainly would not have neglected their diet as Evans had.

Wow! One must eat a lot of penguins, seals, *etc*. and stuff themselves with vitamin C to subsequently avoid scurvy during the former's subsequent prolonged absence in the diet. For that reason, contrary to Lt Evans, Captain Scott did not develop scurvy. Literally nothing can be more wrong and unscientific.

The truth is simple: the human *body* doesn't *create* vitamin C by itself, nor *does* the *body store* it. Most animals have a liver enzyme which enables them to actually manufacture vitamin C *in situ* by conversion of blood sugar into ascorbic acid. However, humans do not have this enzyme. As a consequence, vitamin C, which is required by the human body for the various metabolic reactions, must be included in the human diet. Furthermore, the human body does not have the ability to store vitamin C – if unmetabolized; it is excreted in the urine.

Therefore, Karen May's[119] conclusions are wrong, incorrect and disqualify her contribution to understanding the *Terra Nova Expedition*. Unfortunately, Karen May's false thesis that the human body can store vitamin C was also presented by my favorite fallacious thinker, Dr Susan Solomon, who produced the following bogus notion

> The onset of scurvy varies from one individual to another and depends in part upon the body's reserves [*sic*] … Scott and his men took steps to combat the dreaded disease before starting [*sic*] their southern journey – in particular, consuming fresh seal meat, as did Lt Shackleton on his expedition.

I will return later in this subsection to Dr Solomon's fallacious expounds and her record manipulations. In relation to the above, it may be interesting to add to this observations made by the trained historian presently at the University of Manchester, Dr Max Jones, who gives a partally alternative account[120]

> On the return from the Pole, the explorers consumed [*sic*] a large quantity of pony meat after seventeen weeks on sledging rations, greatly reducing the likelihood of scurvy. Furthermore, the death of Edgar Evans (because of a high altitude cerebral edema, brought on by dehydration, she [Dr Solomon – KS] suggests) would have raised the polar party's rations to an adequate level. Teddy Evans [Lt Evans – KS] alone developed scurvy because he had been on sledging rations longer [*sic*] than any other member of the southern party.

The investigative reader could hardly agree with Dr Jones, who produced additional nonsense. It is as if he forcefully promised himself to find an explanation to the scurvy issue during the Captain Scott party's journey. From section 9.2, we know that the Captain Scott party had not "consumed a large quantity of pony meat". On the contrary, the party left a large number of pony cutlets at Shambles Camp (see section 9.3), and only for 10 days afterward was pony hoosh served.[121] Pony meat contains very little[122] vitamin C, traces of which would have been lost (decomposed) due to the boiling of the hoosh.

Let me turn now to Dr Jones last expound, and let me assume his thesis that a longer time on sledging rations leads to a greater probability of scurvy development. Was Lt Evans really the person who spent the longest time on sledging rations?

Lt Evans spent about 111 days on sledging rations on the Barrier. So Crean and Lashly, who sledged with Lt Evans, had been there the same time, but they did not develop scurvy. Dr Jones does not explain why this was – and neither does Karen May. Going one step further with Dr Jones' account, one must right away conclude that since the Captain Scott party spent the longest time on sledging rations, about 149 days, then they *must* have developed scurvy as well. Since Dr Jones could not admit that Captain Scott's party had scurvy, his analysis was selective and did not take into account all variables.

The investigative reader may wonder if Dr Jones was referring to regarding overall time spent by Lt Evans on sledge rations during the whole *Terra Nova Expedition*. In Tab. 11.7, I summarized all sledging journeys commenced from Cape Evans and the respective time spent hauling the sledges. The conclusion from this table is palpable. Wilson and Bowers had been sledging the longest total time, 286 days. The second was Captain Scott who sledged 227 in total. And Lt Evans sledged for only 146 days in total, roughly half as long as Dr Wilson and Lt Bowers and much less than Captain Scott. Additionally, Captain Oates sledged 191 days altogether, and P. O. Evans 177 days. Therefore, Dr Jones' assertion is wrong and

Table 11.7. Major sledging journeys commenced from Cape Evans.

	Party Name	Time-out	Numbers of Days	Members
1	One Ton Depôt Party	Jan. 26th – Mar. 23rd, 1911	3 days 28 days 56 days	Atkinson[1], Crean[1] Teddy Evans[2], Forde[2], Keohane[2], Meares, Wilson, Scott, Bowers, Oates, Cherry-Garrard, Lashly
2	Taylor's 1st Western Mountain Party	Jan. 27th – Mar. 14th, 1911	47 days	Taylor, Debenham Wright, P.O. Evans
3	Winter Journey to Cape Crozier	Jun. 27th – Aug. 1st, 1911	59 days	Wilson, Bowers, Cherry-Garrard
4	Spring Journey to Corner Camp	Sep. 9th – 15th, 1911	7 days	Teddy Evans, Debenham, Gran
5	Spring Journey to Western Mountains	Sep. 15th – 28th, 1911	24 days	Scott, Wilson, Bowers, P.O. Evans
6	Main Polar Party	Nov. 3rd, 1911 – Mar. 29th, 1912	147 days 135 days 106 days	Scott, Wilson, Bowers Oates P.O. Evans
7	Motor Party	Oct. 27th – Dec. 20th, 1912	55 days	Lt Evans, Lashly, Day, Hooper
8	Dog Sledge Party	Nov. 5th, 1911 – Jan. 4th, 1912	60 days	Meares, Dmitrii
9	Taylor's 2nd Western Mountain Party	Nov. 16th, 1911 – Feb. 15th, 1912	91 days	Taylor, Debenham, Gran, Forde
10	First Return Party	Nov. 3rd, 1911 – Jan. 26th, 1912	84 days	Atkinson, Wright' Keohane, Cherry-Garrard
11	Second Return Party	Nov. 3rd, 1911 – Feb. 22nd, 1912	111 days 118 days[3]	Teddy Evans, Lashly, Crean
12	Day's Depot Party	Dec. 26th, 191 1 – Jan. 21st, 1912	79 days	Nelson, Clissold, Day, Hooper
13	First Relief Party	Feb. 26th – Mar. 16th, 1912	20 days	Cherry-Garrard, Dmitrii
14	Second Relief Party	Mar. 27th – Apr. 1st, 1912	6 days	Atkinson, Keohane

1 Returned from Safety Camp.
2 Returned from (78°57′S; 169°13′E) with the weaker ponies on Feb. 13th, 1911. The return date of Lt Evans to Hut Point is not clear and I assumed that he returned after ten days.
3 For Lt Evans and Lashly, who began the sledging diet at the Motor Party (#7).

unfounded. This nonsensical argument was also repeated by Dr Butler in his own pointless article.[123]

All the above expounds seem to echo Huntford's account, which was not directed at Captain Scott, but with Huntford's usual twist on behalf of Captain Amundsen[124]

> All through the winter, Amundsen's men were building up their stock of Vitamin C, for the human body, although unable to synthesize it, can store it for a time … Seal meat, brown bread, "hot cakes" and berries, were the main food of the Norwegians; a simple, natural and nutritious diet … At Cape Evans … there was white bread, not brown; much tinned food was used, poor in vitamin C. Seal meal was not served daily, and then overdone.
>
> Such, then, was the way each expedition was building up its bodily reserves for the coming trial. Fate was sitting at the dinner table.

Indeed, Huntford is right that the human *body* doesn't create *vitamin C* by itself, but he is wrong that the *body can store* unmetabolized vitamin C. Huntford was the first to say that Captain Amundsen, contrary to Captain Scott, was building up stocks of vitamin C in their bodies. Consequently, the debunkers (Sir Ranulph, Dr Solomon, May, *etc*.) felt compelled to debunk Huntford's notion that Captain Scott was not stuffing his comrades with vitamin C, and the extensive consumption of seal was highlighted.

Huntford, while basing his case on a false assumption, was further critical of Captain Scott's actions[125]

> But mobility was the crux. Three months is about the longest the human body can store [*sic*] vitamin C. Amundsen, who, reducing his philosophy to its simplest terms, had seen safety in speed [*sic*], was back to his sources of vitamin C at the seal meat depots in two and a half months. Scott had now been on the road for almost exactly the same time, and he had not done half his journey yet.

Neither Captain Scott nor Captain Amundsen and their companions could build up a surplus of vitamin C in their bodies.

Despite a fair number of publications devoted to the analysis of Captain Scott's nutritional status of the *Terra Nova Expedition*, these contributions lacked in-depth analysis, and more importantly lacked simple common sense judgment. In what follows, I will use common sense as a sufficient method for arriving at an educated answer to the question of scurvy during Captain Scott's *South Pole Journey*.

In the booklet[126] edited by Colonel H. G. Lyons and entitled *British (Terra Nova) Antarctic Expedition 1910–1913: Miscellaneous Data*, the investigative reader may find a copy of the list made by Lt Bowers of the stores for the Shore Party when the *Terra Nova* left New Zealand for the Antarctic. Under the heading *Articles*, Lt Bowers listed the following general categories: meats, potted meats, fish, soups, vegetables, dried vegetables, cereals, jams, bottled fruits, dried fruits, pickles and sauces, *etc*., sugar, cocoa and chocolate, tea and coffee, milk, butter and cheese, cooking accessories, special travelling foods, wines and spirits, lime juice, *etc*.

Altogether, about 250 entries with quantities and weights, almost as if a whole general store from London was moved to Cape Evans. The question arises: was the vitamin C content in these food stores sufficient to prevent scurvy? I submitted

Lt Bowers' list to a number of nutritionists asking them to evaluate this question. Although certain issues remain unanswered[127], the consensus was reached that that the food listed by Lt Bowers was sufficient to support a scurvy free diet. In addition to the standard foods, about 1000 pints (570 liters) of lime juice was taken to Antarctica. If the food from a standard general store of London was nutritionally sufficient for Londoners, was not it sufficient for Captain Scott's party? For the same reasons, the food taken from the Antwerp (Belgium) general store was not sufficient during the *Belgica Expedition* (1897–1899) and "Dr Frederick Cook … saved the scurvy-stricken crew of the *Belgica* by making them eat fresh meat [seal and penguin meat – KS]."[128] Thus for both Captain Amundsen and Captain Scott, the remedy for scurvy was rather obvious – fresh meat. Despite that, two people – Lt Evans and P. O. Evans – in different degrees abstained from consuming seal meat. This fact could easily explain why both explorers developed scurvy at an early stage of the journey. However, the notion of if and how much of raw meat was consumed remains open. In vain, one would look at various accounts to find an answer to this important question.

In fact, most of the seal meat was either fried or roasted. Pending what the respective and approximate temperatures of frying (175–200)°C and roasting (95–200)°C are, one could certainly suggest that due to the fact that the melting point of vitamin C is about 190°C most of vitamin C in seal cutlets was effectively destroyed. Thus, a certain and important uncertainty remains.

Since the Captain Scott party could not stuff their bodies with unmetabolized vitamin C, and their sledging diet did not contain even a trace of vitamin C, the real (central) question arises: how long does it take a human to survive without vitamin C intake? It is apparently not a simple question. The main research on vitamin C was directed toward understanding the minimum human daily doses of vitamin C to sustain good health, and only in a limited number of research papers was our question about this case's difficulties addressed[129]

> Six apparently healthy men from the Iowa State Penitentiary volunteered for metabolic studies of human scurvy. They were hospitalized on the metabolic ward and given a diet totally devoid of vitamin C but adequate in all other essential nutrients. Although two of the prisoners escaped [*sic*], the remaining four developed clinical signs of scurvy.

Examination of modern research related to scurvy shows that the symptoms of scurvy generally develop after at least *3 months* of severe or total vitamin C deficiency. These symptoms include: skin problems (perifollicular hyperkeratosis papules), oral problems (gums may swell and become red, soft and spongy), *etc.* The time at which the symptoms of scurvy are developed is obviously a complex variable depending on many individual factors; however the +3 months period is commonly accepted by modern standards[130, 131]

> The remaining five subjects developed clinical scurvy in 84 to 97 days, manifested by signs and symptoms of fatigue, hemorrhagic phenomena, swollen joints, swollen bleeding gums, follicular hyperkeratosis, muscular aches and pains, and emotional changes.

The above was confirmed in recent studies.[132]

With that knowledge, I can turn to the *Terra Nova Expedition*. The First Return Party (Dr Atkinson, Cherry-Garrard, Wright and Keohane) had been deprived of vitamin C for 84 days (from Nov. 3rd, 1911 until Jan. 26th, 1912). None of this party was affected by scurvy. The Second Return Party (Lt Evans, Crean and Lashly) had been deprived of vitamin C for 111 days (from Nov. 3rd, 1911 until Feb. 22nd, 1912). Only Lt Evans developed scurvy, of which symptoms were visible from about Jan. 22nd – Feb. 1st (and 4th), 1912.[133] It was after 87–93 days. Surprisingly, Tom Crean and William Lashly did not develop scurvy, and despite possible fatigue symptoms, the former was capable on Feb. 18th of a 30-mile solo trek from Corner Camp to fetch help from Hut Point.

The Tom Crean and William Lashly cases show that even after of 111 days of vitamin C deprivation, the major symptoms of scurvy did not develop. It shows that the range of development of scurvy symptoms is at least 84–97 days, ± 2 weeks.

A question arises: in view of these general scientific estimations is it possible that at the end of March 1912 and after being deprived of vitamin C for roughly 149 days, that the Captain Scott party was not influenced by scurvy?

I think, and I am actually convinced, that the Captain Scott party, in each individual way, suffered and would have had multiple scurvy symptoms. In view of the above-mentioned scientific investigations, it is virtually impossible that human beings would not suffer in different degrees of scurvy after being deprived of vitamin C for more than three months. Since the onset of scurvy symptoms for each individual are not exactly defined and are visible in different parts of the body, the simple organoleptic assessment of only selected parts of the body may be unsatisfactory.

It is worth a little revisit to Dr Solomon's vitamin C expounds. However, despite forsaking completeness of my account, let me add a few clarifying comments. Indeed, these comments will show one more time how Dr Solomon willingly and unscrupulously attempted to confuse the readers. In her book, to suit her goal of proving that the Captain Scott party did not suffer from scurvy, she presented only selected/cherry-picked research results concerning the time of onset of scurvy in a person deprived of vitamin C.

First, Dr Solomon introduces an unreferenced (supported) conjuncture that[134]

> Many historians [*sic*] have assumed [*sic*] that Scott and his men have had scurvy, perhaps making them so weak that they simply could not achieve better distances than a few wretched miles per day in the last several weeks of their lives.

Dr Solomon's conjuncture is indeed terrifying. Since Dr Solomon is not referencing her account, one could consult her listing of "Historical Analyses of the *Terra Nova* and *Discovery* Expeditions"[135] to find a list of seven books, of which three (Huntford, Preston and Thomson) directly concern the *Terra Nova Expedition*. Out of these three authors, only one, Huntford, makes the explicit judgment that Captain Scott had scurvy. Obviously one author, however distinguished, does not account for Dr Solomon's "many historians". However, Dr Solomon's "many historians" statement was made to show how she against "many authors" discovered the opposite of what many authors had "assumed".

Since Dr Atkinson apparently did not find the slightest symptoms of scurvy on Captain Scott, Dr Wilson and Lt Bowers' bodies, why have Dr Solomon's imagi-

nary historians *assumed* counterfactually that the symptoms of scurvy were present? Working along this line, Dr Solomon suggests that these unspecified "historians" have tried to discredit Captain Scott by assuming that his party would have had scurvy. After making this conjuncture, Dr Solomon eagerly continues with her proof[136]

> But what is the specific evidence regarding scurvy in the polar party? The onset of scurvy varies from one individual to another and depends in part upon the body's reserves. Serious symptoms of scurvy have occurred in some test subjects after nineteen weeks [*sic*] on a vitamin C – free diet, and in others after thirty [*sic*] weeks.[50]

Dr Solomon is telling us that somewhere after 19–30 weeks of vitamin C deprivation, the symptoms of scurvy are visible. She is placing the first scurvy symptoms between 19–30 weeks for a good reason. The reason is Captain Scott's 144-days sledging plan. It is almost equal to the actual time before Captain Scott's death, which translates to about 20½ weeks. Comparing this scurvy onset time (19–30 weeks) and time spent by the Captain Scott party on the Barrier the conclusion is palpable: The Captain Scott party did not have scurvy according to Dr Solomon.

As a true scientist, Dr Solomon supports her statement by giving a reference number 50, which is a book by K. J. Carpenter, entitled *The History of Scurvy and Vitamin C*, published by Cambridge University Press in 1986. More specifically, she references to pages 200–203 in this book. The curious and investigative reader may consult Carpenter's book to verify and cross-examine Dr Solomon's statements. Indeed, it only takes a little effort to find that Dr Solomon has once again fabricated and manipulated data. She also ignored scientific publications with results not fitting her notion.

Carpenter, in the subsection *Experimental Scurvy*, describes a few studies. In studies by John Crandon he reported[137] the first symptom (tiredness) appears at 12 weeks and after 23 weeks "small haemorrhages on his lower legs". Interestingly the subject, Dr Crandon himself, inflicted two wounds in his back. One wound "made after thirteen weeks on the diet, showed normal healing ten days later, but the second, made after twenty-six weeks, showed no healing after ten days."[138] The first wound was made at the time when Crandon's body still contained some vitamin C traces in his blood. The second wound was made when no detectable vitamin C was present in his blood.

Another study conducted during World War II in England (the so-called Sheffield study) showed that[139]

> After seventeen weeks, the subjects whose plasma level had fallen fastest showed some hyperkeratotic follicles on his upper arm; four weeks later, six of the ten were showing them, and after twenty weeks all were doing so, with haemorrhages in six of them … It was only after thirty weeks without vitamin C that changes began to be seen in the gums. By the thirty-sixth week, nine out of the ten were showing gross changes: The gums became purplish, swollen, and spongy, with areas of necrosis and bleeding.

How Dr Solomon obtained her time frame from the above data is entirely unknown. Moreover, on page 204, Dr Carpenter describes other important research reported by Hodges *et al*.[140] which was deliberately omitted by Dr Solomon as it did

not fit her notion that scurvy sets on well after 20 weeks of vitamin C deprivation. Hodges *et al*. results[141]

> were very similar to these seen in the other studies except that signs of deficiency appeared earlier – skin changes in 8 to 13 weeks and gum changes in 11 to 19 weeks. The authors suggested that this might have resulted from the more complete removal of ascorbic acid from the diet[142].

Indeed, a much shorter scurvy onset time, and an equally important justification of the result cannot be ignored. By omitting Hodges *et al.* results clearly described in Dr Carpenter's book, Dr Solomon once again committed scientific misconduct by selective citation by citing pages 200–203, but deliberately leaving out page 204 from her reference.

Dr Hodges, on the contrary to previous researchers, continued his investigations of scurvy onset time. Two years after from the above-mentioned first publication, Dr Hodges and co-workers presented the next study.[143] The results, along with the above-mentioned Sheffield study, are collected in Tab. 11.8. It is readily observable from this table that the onset of scurvy symptoms occur at later times than the respective Iowa City studies. Dr Hodges *et al*. concluded[144]

> The British had estimated that their diets contained approximately 1 mg ascorbic acid in a day's ration, yet it required a much longer period of time for their subjects to develop the same signs and symptoms than those that appeared in our subjects (Table 6 [Tab. 11.8 – KS]). These observations suggest the possibility that the British diet might have contained substantially more than the estimated 1 mg ascorbic acid in a day's ration. We

Table 11.8. Summary of Lt Evans' and Captain Scott's sledging journeys during the *Terra Nova Expedition*. All data is taken from my previous analyses based on Dr Simpson's Vol. III data.

Lt Evans' Journeys	**Dates**	**Days**	**Distance**
Corner Camp	Sep. 9th – 16th	7	62
Turks Head	Sep. 23rd – 29th	6	9.5*
Second Return Party	Nov. 3rd – Feb. 22nd**	118	1202
		Σ 131	**Σ 1275.5**

* Due to lack of actual field data I calculated the distance as a straight line.
* + 7 days from Oct. 27th, 1911. See Table 11.7 Motor Party dates.

Captain Scott's Journeys	**Dates**	**Days**	**Distance**
One Ton Depôt	Jan. 26th – Mar. 23rd	56	236
Spring Journey to Western Mountains	Sep. 15th – 28th	24	142
Main Polar Party	Nov. 3rd – Mar. 29th	147	1402
		Σ 227	**Σ 1780**

> know that a dose of 6.5 mg daily was barely enough to ameliorate scurvy in three subjects.

The above comment explains why in the Sheffield study the symptoms of scurvy developed later than in the case of the Iowa City results, where the subjects were entirely vitamin C-deprived. The presence of vitamin C in foods used in the Sheffield studies could result from using food boiling as a faulty method to remove it. However, as already mentioned, the melting point of vitamin C is about 190°C (374°F), so food boiling may not be the most effective method.[145]

From the above, especially from the Iowa City studies I and II, and from other research, one can see that the onset of scurvy symptoms is variable. However, it is reasonable to assume in most cases, the scurvy will onset at about 12 weeks of *complete* vitamin C deprivation.

Let me return to Dr Solomon's lies and data manipulations. After she self-proclaimed that the scurvy onset takes place after 19–30 weeks, Dr Solomon proceeded further to create a completely fake account. By convoluting understatements and lies, she makes the reader formulate the false conjecture that Captain Scott and his party did not suffer from scurvy. She formulates the tacit conjecture by implying that if other explorers who sledged a comparable time did not develop scurvy, then why should Captain Scott have developed it? The reader is asked to read Dr Solomon's original expound.[146] Here I make an effort to give a critical, abbreviated account of it.

First, Dr Solomon asks herself a fundamental question and attempts to find the right answer by bringing in other explorers' accounts[147]

> How long could the men hope to march on a southern journey before becoming first weakened and then incapacitated by the dreaded disease? On his southern journey of more than seventeen weeks, none of Shackleton's party displayed significant [*sic*] symptoms of scurvy.[52] Lashly, Crean, and Lieutenant Evans left the bulk of their pony meat behind for [*sic*] Scott's party … the ill lieutenant had been sledging for several weeks longer [*sic*] than his companions, and his initial symptoms of scurvy began after about twenty-one weeks [*sic*] on the sledging diet … The polar party began the progress slowly near the beginning of March, after about seventeen weeks on the sledging trail, and they perished after twenty-one weeks.

After reading the above account, many – including Sir Ranulph Fiennes and Dr Jones – shouted *chapeau bas*, this is the proof that Captain Scott had not "succumbed to scurvy".[148] However, Dr Solomon proved nothing, she as we have seen many times before just lied to the readers. The lie is built on the false notion that Lt Evans developed scurvy symptoms "after about twenty-one weeks [*sic*] on the sledging diet".

I have already, in the above discussion, addressed this question. It is resolved in Tab. 11.7, summarizing all sledging journeys commenced from Cape Evans and the respective time spent hauling the sledges. If for unspecified reasons one is counting the overall time spent on a sledging diet by each explorer, then one finds that Lt Evans sledged only 125 days (18 weeks), less than half as long as Dr Wilson and Lt Bowers (286 days) and much less than Captain Scott's 227 days. Therefore, Dr Solomon's comment that Lt Evans was about "twenty-one weeks on the sledging diet" is a lie.

More importantly, the vitamin C deficiency resulting in scurvy is not an *additive* variable. Let's say that the symptoms of scurvy onset after 12 weeks of vitamin C deprivation. However, this vitamin C deprivation must be consecutive in time. If not, and if the subject in the meantime consumes some vitamin C, the onset of scurvy will be delayed or stopped. Even if the subject happens to drink only water on random days for a total 84 (12 weeks × 7 days) days during his lifetime, he will not develop scurvy.

Thinking in Dr Solomon's terms that the total time length spent on sledging rations determines the onset of scurvy, then one could add Captain Scott's 232 days during the *Terra Nova Expedition* to say +152 days[149] during the *Discovery Expedition* and state, as compared to Lt Evans scurvy, that Captain Scott *must* have severe scurvy or be dead a year before (his actual death) on Mar. 23rd, 1911, when the party returned after One Ton Depôt was established. Or is Dr Solomon suggesting that humans cannot have scurvy after being deprived of vitamin C for more than one year?

It shows that Dr Solomon produced lies and nonsense to develop her notion that the Captain Scott party did not suffer scurvy.

In summary, one must notice the problems posited before the authors: since Lt Evans had scurvy, how is this possible that the Captain Scott party did not have it? The following publication time ordered explanations have been presented:

- [Dr Solomon][150] Lt Evans "had been sledging for several weeks [*sic*] longer than his companions, and his initial symptoms of scurvy began after about twenty-one weeks on the sledging diet",
- [Dr Jones][151] "Teddy Evans alone developed scurvy because he had been on sledging rations longer [*sic*] than any other member of the southern party",
- [Sir Ranulph][152] "Evans himself explained that apparent anomaly by pointing out that for seven weeks [*sic*] prior to the team's departure from Cape Evans he had been involved in survey work and depot-laying, during which he ate sledge rations … Evans had completed 400 more [*sic*] miles of manhauling then the men of the Polar group",
- [May and Lewis][153] "Teddy Evans, the only recorded scurvy sufferer on the *Terra Nova* expedition, had avoided eating the fresh meat recommended by Wilson".

All the above accounts are false, incorrect, and possibly are data manipulations for the reasons enumerated earlier. The funniest and most ridiculous account was, of course, given of course by Sir Ranulph. He really detached himself from simple facts to prove that because Lt Evans had sledged and had been on much more sledging rations than the Captain Scott party, he got scurvy and not the Main Polar party. Unfortunately, it is a lie, factual and logical (scientific). Indeed, Sir Ranulph committed bravado to prove something improvable. I wonder how Sir Ranulph could explain the following.

In Tab. 11.8, I summarized all the sledging journeys commenced by Lt Evans and Captain Scott during the *Terra Nova Expedition*. The analysis of this data is indeed palpable. Lt Evans had been sledging for 1276 miles, and Captain Scott for 1780 miles. Contrary to Sir Ranulph's record, Captain Scott sledged for 505 miles farther than Lt Evans. Thus, Sir Ranulph's error is about 905 miles, just about 21% more than the distance between Hut Point and the South Pole.

Thinking along Sir Ranulph's lines that the total length of miles spent on sledging rations is determinant for scurvy onset, Sir Ranulph should be ready to answer why the Captain Scott party did not perish due to scurvy after reaching the South Pole.

Then there is the inconvenient fact that in the *Discovery Expedition*, Dr Wilson's diary entry for Jan. 14th, 1903 acknowledged that "we all have slight, though definite symptoms of scurvy". That Jan. 14th was the 73rd out of 93 (10½ week) days of their journey, and they already showed symptoms of scurvy. The scurvy quickly overwhelmed Lt Shackleton, who finally was carried on the sledge by Captain Scott and Dr Wilson.

This development clearly shows that while, on the same diet, different people respond in different ways while vitamin C – deprived. It shows that Captain Scott's and Dr Wilson's bodies were resilient to low or non-existent vitamin C intake. Interestingly, it also raises another question: what was different in the sledging rations of Lt Shackleton's *Furthest South Journey*, or Captain Scott's *South Pole Journey,* that caused both parties to not have scurvy? The reason is indeed two-fold.

The first reason is that *both* parties before embarking on their respective journeys consumed certain quantities of fresh meat. It simply meant that the explorers before embarking on their journeys would have had a balanced diet with a sufficient intake of vitamin C, ensuring they were not on their way to developing scurvy.

The second reason is equally prosaic. For both parties but in different degrees it was pony meat. We know now that pony meat is not particularly rich in vitamin C. One pound contains about 4.5 mg of vitamin C.[154] It appears that in the case of Lt Shackleton, it was pony meat consumed during the journey which helped to battle vitamin C deficiency in a very limited way, "we had frozen raw pony meat to eat on the march".[155]

Captain Scott's case is more complicated. We know that Captain Scott envisioned a 144-days sledging plan. From the previous chapters, we also know how his logistics were set up and consequently executed. What remains unknown is how Captain Scott planned to battle scurvy during his journey. Of course, he had to have recalled Lt Shackleton's case and its onset after only 73 days journey at the turn of 1902 and 1903. Ultimately, he was planning a sledging schedule twice as long as Lt Shackleton's scurvy onset time!

Unfortunately to our further understanding of Captain Scott's expedition, not a word can be found. It is indeed disturbing for the analytically minded reader. On Aug. 17th, 1911 Dr Atkinson lectured on scurvy at Cape Evans, and Captain Scott commented[156]

> His remarks were extremely sound and practical as usual. He proved the value of fresh meat in polar regions. Scurvy seems very far away from us this time, yet after our Discovery experience, one feels that no trouble can be too great or no precaution too small to be adopted to keep it at bay. Therefore such an evening as last was well spent. It is certain we shall not have the disease here, but one cannot foresee equally certain avoidance in the southern journey to come. All one can do is to take every possible precaution.

From the way Captain Scott writes, it is not clear who proved the value of *fresh meat* to combat scurvy – Dr Atkinson or Dr Wilson. What is clear is that Captain Scott understood how he could keep scurvy at bay in a limited way. Additionally, one must observe that despite a properly addressed question and correct analysis, not a word came from Captain Scott on this life or death issue. It is indeed astonishing. Negligence, ignorance or perhaps a secret plan not to disclose certain sensitive information? Is it possible that Captain Scott dived into the limitless continent of Antarctica without implementing measures against scurvy?

It appears to be the case. Captain Scott did not take adequate measures to ensure that the fresh meat (frozen) would be available and consumed by his party during the *South Pole Journey*. The investigative reader could ask about the pony meat cutlets deposited at Shambles Camp. The ponies were shot, and the Captain Scott party continued towards the Beardmore Glacier. On the return journey, insufficient pony meat was taken from there, and none from other locations where pony meat was depôted. I am also aware that an unspecified amount of pony meat was taken from Shambles Camp to feed Meares' dogs while he was accompanying Captain Scott's party for a while on the ascent of the Beardmore Glacier. However, it was only for dog feeding and thus limited due to the dog's greater speed.[157]

As one could provide only a few educated reasons to account for the above scenario, one is unable to figure out *why* on the way back from the Pole did the Captain Scott party, while clearly under loaded, casually pass by the Shambles Camp, and consume relatively few hoosh meals.

Interestingly, if one recalls Captain Scott's orders to Meares and Dr Simpson, and consequently to Dr Atkinson, one must seriously consider why Captain Scott did not order them to bring or re-supply depôts with fresh cutlets. Sadly, no reasonable answer can be given.

The investigative reader should recall that on Feb. 22nd, 1912, when the Second Return party arrived at Hut Point with the scorbutic Lt Evans, no one, including Dr Atkinson, dispatched fresh cutlets or seal liver. We know from Chapter 10 that from Cape Evans, phony supporting parties were sent, and dispatching true and real supporting parties did not happen. Here, and in connection to the above analysis, it is interesting to recall Cherry-Garrard's diary[158]

> March 25. The wind came away yesterday evening, first S.W. and then S.E. but not bad, though very thick. It was a surprise to find we could see the Western Mountains this morning, and I believe it has been a good day [*sic*] on the Barrier, though it is still blowing with low drift this evening. We are now on the days when I expect the Polar Party in: pray God [*sic*] I may be right. Atkinson and I look at one another, and he looks, and I feel, quite haggard with anxiety [*sic*]. He says he does not think [*sic*] they have scurvy.

Besides the fact that the wind conditions at Cape Evans were mild compared to the gale reported by Captain Scott, one certainly has to wonder how Dr Atkinson, *more than one month* after the seriously scorbutic Teddy Evans returned, was still thinking that Captain Scott was scurvy free. No argument was provided, and only Dr Atkinson's self-excusing statement survives.

How could Dr Atkinson, on Mar. 25th, 1912, 32 long days after the scorbutic Lt Evans returned, not think that anyone in the Captain Scott party had scurvy? Indeed, an incomprehensible *ad rem*.

⋮

The funny thing is that on Mar. 25th, 1912, Dr Atkinson could not say anything to the contrary. Since he presented a lecture on scurvy on Aug. 17th, 1911 he inadvertently (or not) became responsible for scurvy-related issues during Captain Scott's southern journey. Additionally, after Dr Simpson's mutiny (and escape from Antarctica), Dr Atkinson unwillingly assumed command at Cape Evans. By then,

he was not only responsible for preventing scurvy, but also as a commander (at Cape Evans) for the Captain Scott party. Divided councils between loyalty to comrades and self-preservation slowly shifted toward the latter instinct, and no genuine actions were ordered or/and taken.

However, not everyone at Cape Evans shared Dr Atkinson's view. It was at least one explorer, the Royal Navy Chief Stoker William Lashly who "was inclined to think they had [Captain Scott party] had scurvy".[159] However, this opinion from a simple Chief Stoker, R. N. was ignored. Lashly would not give up.

In *The Worst Journey in the World,* Cherry-Garrard related a conversation with Lashly[160]

> I told him [that I thought they had met their end in] a crevasse. He says he does not think so; he thinks it is scurvy … Lashly thinks it would be practically impossible for five men to disappear down a crevasse. Where three men got through [his own party with Crean and Lieutenant Evans – KS] five men would be still better off. This is not my view however.

Returning to Tab. 11.9 and to the Iowa City studies, one must readily confirm, supported by additional recent research results,[161] that the onset of scurvy for an individual entirely deprived of vitamin C occurs – pending interference by individual (personal) metabolism rates – at about 12–13 weeks (90 days). It is almost precisely

Table 11.9. Comparison between the Sheffield and Iowa City studies.[1]

	Sheffield study	**Iowa City studies I and II**
No change	up to 119 days	up to 29 days
Petechial haemorrhages (not perifollicular)	–	26 to 66 days
Follicular hyperkeratosis	82 to 149 days	45 to 100 days
Aching of limbs 149 to 168 days		64 to 96 days
Swollen or bleeding gums	163 to 254 days	38 to 105 days
Perifollicular haemorrhage	182 to 238 days	49 to 90 days
Acne	114 to 210 days	no change
Joint effusions	210 to 216 days	68 to 103 days
Edema, slight to marked	–	33 to 101 days
Neuropathy	–	71 days
Sicca syndrome	–	58 to 123 days
Ocular haemorrhages	–	84 to 95 days

[1] Hodges, Robert E., James Hood, John E. Canham, Howerde E. Sauberlich, and Eugene M. Baker, *Clinical Manifestations of Ascorbic Acid Deficiency in Man*, The American Journal of Clinical Nutrition **24**(1971)432–443. See also John Pemberton, *Medical Experiments Carried out in Sheffield on Conscientious Objectors to Military Service During the 1939–45 War*, International Journal of Epidemiology **35**(2006)556–558.

the time it took Lt Evans to develop his first scurvy symptoms. However, Lashly and Crean did not develop scurvy.

To find an answer as to why Lashly and Crean did not develop or did not have any detectable symptoms of scurvy, one does not have to resort to lies and data dragging. The answer to why they did not have scurvy symptoms is prosaic. All of them, including the Captain Scott main party, *were not entirely* vitamin C – deprived during the *South Pole Journey*.

For obvious reasons, we will never know what exactly was the nutritional content of Captain Scott's sledging rations. However, certain educated approximations have been made. Recalling Dr Atkinson's lecture and its main conclusion, acknowledged by Captain Scott, the first obvious source of vitamin C during the *South Pole Journey* was the meat of the five ponies stored at Shambles Camp. It was not only Captain Scott's opinion, but also "[Dr] Wilson was strongly of opinion [*sic*] that fresh meat alone would stop scurvy".[162]

Combined with the fact that eating horse meat was not a taboo for the British, one could rightly assume that for all returning parties the Shambles Camp and its storage was a salvation for anti-scurvy treatment. Recalling that on the return leg all parties were sledging with a minimum food and fuel load, one must presume that to combat scurvy, the parties ought to have eaten and taken the pony cutlets for further consumption.

It is indeed astonishing that this never happened. All parties, including Captain Scott's, went by Shambles Camp, almost as if nothing interesting was there, and Lashly commented in his diary[163]

> When we began to descend on to the Barrier it only required one of us to drag the sledge down to within a mile of the pony and sledge depot, after exchanging our sledge as arranged, picking up a small amount [*sic*] of pony meat, and fitted up bamboo for mast so that we shall be able to fix up a sail when favourable, we proceeded on our way to cross the Barrier.

The sledging rations were made of: *biscuits*, *pemmican*, butter, sugar, chocolate, cocoa, *cereals* and *raisins*.[164] The components of Captain Scott's food rations given in italics *may* potentially contain variable amounts (concentrations) of vitamin C. The Barrier ration of dried raisins[165] was 0.86 oz (24.4 g) per day which is about 0.65 mg C and according to modern standards it is only about 1% of the recommended daily vitamin C intake. Not much indeed.

What about pemmican? Is it possible that Captain Scott's pemmican may have contained some vitamin C? The commonly accepted answer is no, pemmican does not contain vitamin C. However, the investigative reader may rightly ask: how do we know that? The simple questions are very often the most difficult to answer.

Thinking about the diet of the Inuit people, especially during the winter months when capturing fresh game was difficult or impossible, one inevitably falls on the question of vitamin C in their diet. Since these people survived and indeed flourished in their environment, the food prepared and preserved (by various methods) during its abundance must contain significant amounts of vitamins including vitamin C.

Indeed, modern research along these lines confirms that the food consumed by Inuit people in a raw and cooked state contains fair concentrations of vitamin C.[166] What is most interesting from this research is that boiling food items does not lead

to a substantial decrease in vitamin C content.[167] It means that thermal treatment of meat items, provided that is done at temperatures lower than the melting point of vitamin C (190°C (374°F)) at normal pressure, does not substantially lower its concentration in meat items.

Despite my research to find what type of pemmican Captain Scott used during his *Terra Nova Expedition*, I could not find any reliable piece of information besides that the commercial company named J. D. Beauvais[168] from Copenhagen prepared 3,500 ℔[169] of pemmican. The same company prepared pemmican for the *Discovery Expedition*[170] and *Nimrod Expedition*.[171] However, that is all and the trail stops.

Once again, I find that the most vital element of *Captain Scott's Journey* is poorly or rather not at all described. It shows Captain Scott's negligence and utterly non-scientific approach to his own expedition. Why did Captain Scott not account in a more precise and analytical way on his food rations, including the content of his pemmican? When describing his *Discovery Expedition*, Captain Scott give two figures for lard content in his pemmican, 50% and 60%. And, of course, we do not know which one was correct. Lt Shackleton was more precise in his account of the *Nimrod Expedition* food rations, and described his pemmican as beef and 60% fat.

Regardless of what the exact composition of Captain Scott's pemmican was, it was made by the J. D. Beauvais company, and if it was made in a traditional way (beef + lard), it did not contain a traceable vitamin C concentration (content), contrary to Captain Amundsen's pemmican[172]

> The pemmican we took was essentially different from that which former expeditions had used. Previously the pemmican had contained nothing but the desired mixture of dried meat and lard; ours had, besides these, vegetables and oatmeal, an addition which greatly improves its flavour, and, as far as we could judge, makes it easier to digest.

Thus, it appears that the Captain Scott party's sledging diet was almost entirely free of vitamin C if one neglects its small amounts from consumed raisins. Since Captain Scott knew that during his previous expedition (*Discovery Expedition*) that Lt Shackleton developed scurvy during their *Southern Journey* (Nov. 2^{nd}, 1902 – Feb. 3^{rd}, 1903, 93 days), it is puzzling to figure out how he was planning to combat scurvy without *changing* the sledging diet (rations). Or, maybe Captain Scott was not planning for it, and relied on the notion that somehow scurvy would not develop during the *South Pole Journey*. It is an interesting thought, but it does not explain Captain Scott's ignorance in the matter. It does not explain two issues. From Captain Scott's account and from other expedition members' accounts, it appears that the importance of eating fresh meat to combat scurvy was well understood. I presume that it was also understood that increasing time on sledging rations lead inevitably to an increasing chance of scurvy development. Alternatively, since consumption of fresh meat to prevent scurvy was acknowledged:

- Why did the Captain Scott party not fully consume and take the fresh (though frozen) pony meat cutlets deposited at Shambles Camp?
- Why did Dr Wilson, who was fully aware of the importance of fresh meat, not insist everyone consume and to take most of, if not all of, the pony meat stored at Shambles Camp?

- Why did Captain Scott, while writing orders to Meares, not order him to re-supply One Ton Depôt with fresh (frozen) seal meat instead of (or in addition to) regular sledging rations?
- Why did Dr Atkinson, after learning that Lt Evans had had scurvy, not order Cherry-Garrard to take the now clearly necessary seal meat rations to One Ton Depôt?
- Why did Dr Atkinson, while on the so-called Second Relief Party, not take with him and deposit a load of fresh (frozen) seal meat at Corner Camp?

These are perplexing questions, and the search for answers falls short on rational accounts and explanations. I addressed at least some parts of these questions in the previous chapters, and will again in the next chapter. Here, let me come to an end with the issue of vitamin C deficiency and the Captain Scott party.

From the above discussion, one can readily conclude that Captain Scott's sledging rations were almost certainly vitamin C free. In addition, the consumed hoosh on the way back from the pole contained very little vitamin C, if any at all. These facts, combined with the scurvy symptoms of Lt Evans, P. O. Evans, and Captain Oates, and with the presented studies of scurvy symptom onset times, form *circumstantial* evidence that Captain Scott's final party (Captain Scott, Dr Wilson and Lt Bowers) must have been influenced by scurvy. The degree of scurvy symptoms may vary for each individual; however, it is virtually impossible that towards the end of March 1912 the Captain Scott party did not develop scurvy. It is possibly evidenced by Captain Scott's comment on Mar. 18th "My right foot has gone, nearly all the toes two days ago I was proud possessor of best feet." The sudden and rapid development of frostbite is possibly evidence that Captain Scott's tissue was already in a very fragile state, if Captain Scott can be believed.

11.1.13. Neglecting the Sick

This is the last cause of the disaster amongst a whole array of reasons. This time, it was enumerated by Captain Scott in his farewell letter to Vice-Admiral Sir Francis Charles Bridgeman[173] when he observed

> We could have come through had we neglected the sick.

I had already critically cited Captain Scott's letter to Sir Bridgeman in conjunction with another entry in it, specifically with

> Excuse writing it is –40[°F], and has been for nigh a month.

Let me recall that by writing the above line, Captain Scott, as I discussed in much greater detail in Chapter 7, summarized the notion of the *Extreme Cold Snap* lasting at least from Feb. 27th through Mar. 27th, 1912. We know that Captain Scott falsified the temperature record of his *South Pole Journey*. With this fact in mind, the investigative reader might rightly wonder how truthful (accurate) is Captain Scott's account about the ability of Captain Scott going through if they had neglected the sick, namely P. O. Evans and Captain Oates.

With one stroke of the pencil, Captain Scott throws away *all* his reasons for the disaster. It was not the loss of ponies in March 1911, neither the gale at 83°S or the

soft snow. It was not the surprise awaiting the party on the Barrier, the *Extreme Cold Snap*, or the *Never Ending Gale*. It was if, and only if, they had not taken care of the sick, they "could have come through".

A question of the meaning of Captain Scott's line arises. Is he saying that:

- By neglecting (abandoning) the sick, the remaining members would have had more food/fuel for their use and would not have suffered the shortages reported by Captain Scott, or
- By neglecting (abandoning) the sick, the party would have sledged at greater velocity and thus could have come through,
- Or both.

The negative answers to the above questions have already been presented in various contexts in the previous chapters. Here, let me one more time look at the *sustained* sledging performance of the Captain Scott party. By looking at sustained rather than minute, say daily performance, one eliminates temporary fluctuations and is able to look at general trends in performance. Indeed, it is like looking at climate rather than the weather.

The respective sustained and daily sledging performance of the Captain Scott party is depicted on Fig. 11.9.B. One can readily notice that the daily sledging distances fluctuate between 0–20 miles/day. These fluctuations are dependent on many variables, but chiefly on the weather. Consequently, since the weather is a complex variable by itself, the daily sledging performance is variable. However, by looking at sustained sledging velocity, one suppresses these minute daily fluctuations, and the trend of these sustained changes is clearly emerging.

On this figure, three distinctive regions of sustained sledging velocity are clearly visible. The first region from the start until the Antarctic Plateau; the second section until the Beardmore Glacier is approached on the way back; and the third region down from Plateau until the end.

In the third region, from the entrance of the Beardmore Glacier until the very end, the party's systematic decrease of sustained sledging velocity is evident. In this period of time, many different events had taken place – geologizing, good and bad weather and surfaces, P. O. Evans' and Captain Oates' health troubles and ultimately death. Despite all of that, every day the *sustained sledging velocity* was gradually decreasing. Its negative trend is evident. It is equally evident that the related daily sledging velocity events did not influence and change the negative sustained sledging performance of Captain Scott's party.

It is likely that P. O. Evans and Captain Oates' health incapacities, or geologizing, temporarily slowed the party. However, while geologizing, the party was resting and recuperating. In a normal situation, the lost distance was regained not long after a temporary setback. A sustained negative trend in sledging velocity from the time the party started to descend the Beardmore Glacier is present and lasted to the end.

What Captain Scott is entirely neglecting in his comment is the apparent contradiction between his alleged food/fuel shortages and the "benefit" of P. O. Evans' and Captain Oates' deaths on allotted rations (see section 9.4 and Tab. 9.4).

Within the final party, it was not only Captain Scott who suggested that if the party neglected the sick, the outcome would be different. A similar unfounded view was shared by Lt Bowers, who in the letter to his mother commented[174]

> Our sick companions have delayed us till too late in the season which has made us very short of fuel and we are now out of food as well.

Let us assume that indeed Captain Scott and Lt Bowers' assertion is right, and that they could "come through" if they neglected the sick. Captain Oates perished on his birthday on Mar. 17th, 1912. It was the 136th sledging day, and according to the 144-days schedule the party was as depicted on Fig. 11.17 just about 3 (three) days behind it.

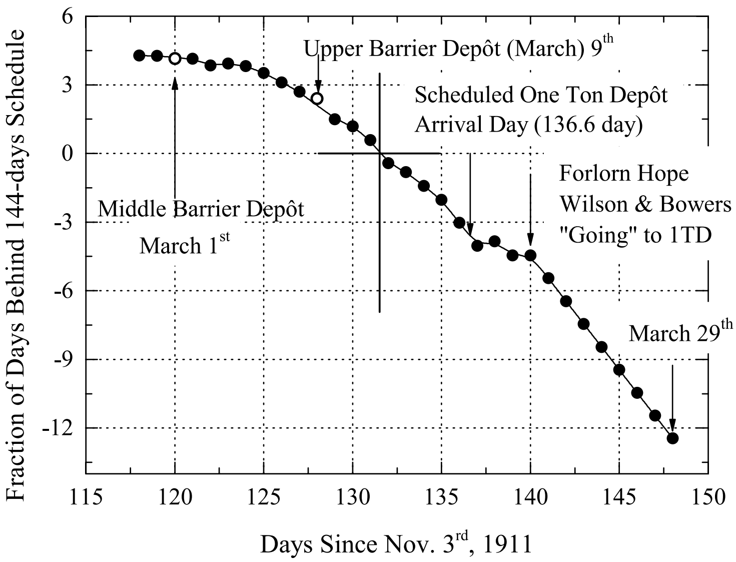


Figure 11.17. The fraction of days behind the 144-days schedule of the Captain Scott party in March 1912. The cross indicates day ~131½, when the Captain Scott party was sledging right on schedule.

It represented a barely ~2% delay, or 3 daily food/fuel rations for 5 men, which translates into 31 daily sledging rations in possession (available to) to the remaining Captain Scott party (Scott, Wilson and Bowers). Thus on the day of Captain Oates' death, the Captain Scott party had food/fuel for at least 10 (31/3 = 10⅓) *full* sledging days. This simple fact was not acknowledged by both Captain Scott and Lt Bowers.

Since the state of being sick is a fuzzy concept, what method was Captain Scott suggesting to determine as to which moment of sickness the fellow explorer should be abandoned? However, Captain Scott's "holier-than-thou" suggestion is unacceptable, and is not reflected in the steady negative gradient of sustained sledging velocity after his party started to descend the Beardmore Glacier. This steady decrease of sledging velocity determined the fate of Captain Scott and its party.

However, from the results of subsection 11.1.10 – *Food Shortages on the Barrier*, Captain Scott's notion "We could have come through had we neglected the sick." receives a new perspective. If for some reason the deaths of P. O. Evans and Captain Oates did not take place, and the Captain Scott party progressed with its original

sledging velocities (see Fig. 11.16), then on about Mar. 15th (135th sledging day), they would have been out of food/fuel rations, including the rations picked up from depôts.

On Fig. 11.18, I depicted a number of daily food/fuel rations available to the Captain Scott party if the party was sledging as a five, four and three men party in the actual March 1912 time frame. By the same time frame, I mean that the negative velocity gradient (trend) observed from the moment when the Captain Scott party left the Antarctic Plateau and descended the Beardmore Glacier was still present. Fig. 11.18 is indeed an illustrative figure. If the party was sledging as a five man party as originally assumed, it would be out of food/fuel on Mar. 16th. However, due to the death of P. O. Evans on Feb. 17th the party was a four man party, and thus every sledging day one ration originally meant to be consumed by P. O. Evans was "saved" and later consumed by those who were alive. The full food/fuel rations for a party of four would end on Mar. 25th. In reality, Captain Oates perished on Mar. 17th and one more time, extra rations were "saved". The party of three, Captain Scott, Dr Wilson, and Lt Bowers could sledge on *full* rations until Mar. 27th, 1912.

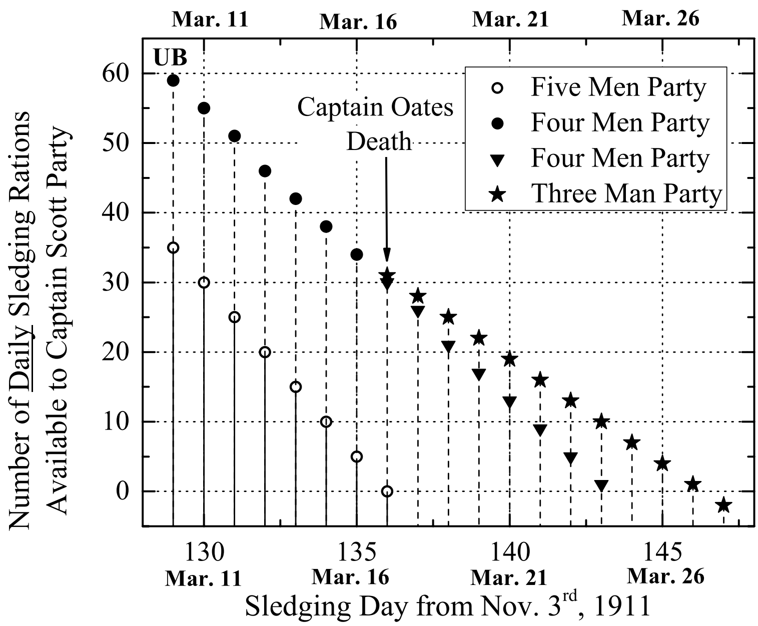


Figure 11.18. The number of daily sledging rations available to Captain Scott's five-man party (○: Scott, Wilson, Bowers, Oates and Evans), four man party (● and ▼: Scott, Wilson, Bowers and Oates) and three man party (★: Scott, Wilson and Bowers) party, respectively. The triangles ▼ represent a hypothetical situation in which Captain Oates did not perish.

Therefore, from the day of Captain Oates' death on Mar. 17th, the party had *full* food rations for at least 10 long days. On this date, the party was at Camp #14, which was reached previously (–79.91667) on Nov. 18th, 1911. Its distance from One Ton Depôt was about 26 miles. On the next day after Captain Oates' death, Captain Scott reports, "My right foot has gone". According to his notion discussed in the

current subsection, if Dr Wilson and Lt Bowers had neglected him, they "could have come through"? Despite Captain Scott not being able to walk, the party according to Captain Scott's journal was supposedly able to advance several miles and on Mar. 19th they were 15½ miles from One Ton Depôt. Thus, in two days they supposedly sledged 11½ miles with an incapacitated Captain Scott. In practice, this did not happen, and the party's last camp was 21–22 miles from One Ton Depôt (see section 10.6). In the meantime, on Mar. 18th, Captain Scott and Dr Wilson presented a prophecy

> We leave here our theodolite, a camera, and Oates' sleeping-bags. Diaries, &c, and geological specimens carried at Wilson's special request, will be found with us [*sic*] or on our sledge [*sic*].

And that is precisely what happened. Coincidence or planning? If planning, then what preparation? Indeed the specimens, all 35 ℔ of rocks, were found next to the Captain Scott party's tent. As much as they were useless (see section 9.3), they provided literary fuel for those who worshiped the Captain Scott party's supreme sacrifice for science and knowledge. However, dragging or not dragging specimens is, and was, a false dilemma – an informal fallacy, which involves consideration of a contrary (but not necessarily) contradictory alternative: either/or. The claim of dragging or not dragging specimens presents an artificially limited range of choices, and Dr Wilson's drawings of imprints present on specimens would increase the range of choices (see subsection 11.1.11).

Exactly the same false dilemma is also involved in considering neglecting or not neglecting the sick, and thus coming or not coming through. The issue of coming through was very complex. Many variables have been involved, and reducing this apparent complexity to an either/or case one more time presents an artificially limited range of choices (reasons). Captain Scott, as I discussed in previous subsections of this chapter, presented his own range of causes of the disaster.

There is one additional and important argument to suggest that if Captain Scott neglected the sick, P. O. Evans and Captain Oates, then his party would go through. This argument is directly related to the weight of the sledge. Let me recall that on the way to the South Pole, the Captain Scott party departed from the Lower Glacier Depôt fully loaded with provisions and gear. During the ascent of the Beardmore Glacier, *each* party initially dragged 7 units and maintained a fine sledging velocity. At the Plateau, Captain Scott and the Second Return Party, despite being loaded with 6 units, were able to increase its sledging velocity. Since the weight of each unit was 2.15 ℔ × 4 men × 7 days = 60.2 ℔ (27.3 kg), it meant that the party of four men was capable of dragging 7 (or 8) × 60.2 ℔ = 421.4 ℔ (191.1 kg).

On the way back, the Captain Scott party sledged between depôts with a minimal food/fuel load to get them between depôts. Thus, for example, the *initial* weight of provisions at the Middle Glacier Depôt ¾ × (60.2 ℔ + 7 × 2.15 ℔) = 56.4 ℔ (for a ¾ amount see Fig. 9.8) which is 13.4% of what is possible (421.4 ℔). Therefore, by adding P. O. Evans' weight, say 180 ℔ or less, on the sledge, the party of four was dragging from the Middle Glacier Depôt about 56.4 ℔ (food/fuel) + 180 ℔ or lower (Evans) + 35 ℔ (specimens) 271.4 ℔. The last figure is just about half what the party could drag in a sustained manner. Consequently, even if P. O. Evans was ordered to sit on the sledge to be hauled, the remaining party should have been able to continue sledging at the expected velocity of 10.1 miles per day. This simple observation once

again begs one to re-think the reasons why on Feb. 17th, 1912, the Captain Scott party almost left behind P. O. Evans.

The above weight considerations are also pertinent to Captain Oates.

In summary, it appears that the last leg of the Captain Scott party's journey from the end of the Antarctic Plateau until the last camp and the resulting *sustained* sledging velocity was *independent* of all related events (geologizing, sickness, depôt location, *etc.*), and exhibited a *steady* negative gradient. Therefore, Captain Scott's pathetic comments do not reflect the actual reasons for the disaster or the party's actual intentions. One should also bear in mind that the deaths of P. O. Evans and Captain Oates resulted in additional food/fuel rations to be used by the remaining three men in the Captain Scott party. These additional rations permitted the Captain Scott party to be on full rations until Mar. 27th, 1912.

After answering the above questions, other issues still remain to be addressed. Three important questions appear to the investigative reader

- Why did Captain Scott feel obliged to mention in his farewell letter to Vice-Admiral Sir Francis Charles Bridgeman that "We could have come through had we neglected the sick"?
- Why was this private (personal) letter published in Captain Scott's published journal?
- What did Captain Scott mean by "come through"?

The letter is not dated, but from its context and from the line "Excuse writing – it is – 40°, and has been for nigh a month. [*sic*]" (see also Chapter 7) that since the *Extreme Cold Snap* started on Feb. 27th one can assume that the letter was composed just before Mar. 27th and at about the same date as the *Message to the Public*. In it, Captain Scott summarized his expedition and the causes of disaster as described previously (subsections 11.1.1 through 11.1.15). In the letter, like a drowning man, Captain Scott clutches at a straw and with one stroke of the pen rewrites the story by telling Sir Francis the sensational notion "We could have come through had we neglected the sick". The cause of the disaster was from compassion to Petty Officer Edgar Evans and Captain Oates, otherwise the Party would "have come through".

Is Captain Scott blaming P. O. Evans and Captain Oates for the deaths of his party, as both of them were no longer a part of the party? No, Captain Scott is saying to Sir Francis that he, Dr Wilson, and Lt Bowers sacrificed their own lives by looking after their comrades. That is indeed a gallant action, and for that reason the letter was published in the printed version of Captain Scott's journal to support the heroic ambiance of the expedition and its last days. The recent Captain Scott hagiographers Karen May and Sarah Airriess detected that unspecified "modern revisionists" forgot that[175]

> Also, it must not be forgotten that, as Scott declared in a farewell letter, "We could have come through had we neglected the sick" (Scott 1913: 413). Scott knew that he, Wilson and Bowers could have maintained a faster pace and conceivably saved themselves had they abandoned Petty Officer Edgar Evans and Oates when they became burdens. That Scott, Wilson and Bowers risked their own safety to improve their companions' chance of survival is the genuinely heroic narrative of which contemporaries such as

> Fridtjof Nansen were well aware ("had it not been for the breakdown of some of his comrades, whom Scott could never think of leaving behind, he could have easily have pulled through" (Nansen 1929: 6)), but of which modern revisionists [*sic*] appear to have lost sight.

With due respect to Dr Nansen and doubtful respect to the authors of the above account, their comments are counterfactual to what Captain Scott enumerated in his *Message to the Public*. Apparently, Dr Nansen, May and Airriess "have lost sight" of the basic facts described by Captain Scott in the *Message to the Public*. With a little more research and thus insight one, as I presented in Chapter 9, may arrive at the entirely opposite conclusion, a terribly obscure deduction that the deaths of P. O. Evans and Captain Oates *meant salvation* to the remaining party. Each death meant that the food/fuel originally allocated to P. O. Evans from Feb. 17th and later to Captain Oates from Mar. 16th was available, and could be used by the remaining comrades. These "extra" provisions enabled the party of four, and the later party of three, to *consume full food/fuel daily rations until* <u>March 27th, 1912</u> (see also sections 9.3, 9.4 and Fig. 11.18).

In addition to the above, one has to dismiss the opinions expressed by Captain Scott and Lt Bowers that the sick companions slowed down the sledging. Let me recall here what was described in detail in the above subsection. While going to the South Pole, the party of four was dragging at least 421.4 ℔ of food/fuel weight and I assume that it was the maximum weight of consumable items to be sledged by four men at a sustained velocity of 10.1 miles per day. Thus, I assume that sledging the weight of 421.4 ℔ by four men at velocity 10.1 miles/day represents 100% efficiency. Additionally, I assume that this relationship is linear. This means that for five men the weight is 421.4 ℔ + 421.4 ℔/4 = 526.8 ℔, and for three men 421.4 ℔ – 421.4 ℔/4 = 316.1 ℔. Indeed, this assumption was practically and positively implemented by the Pole party (five men), and the Second Return Party (three men).

During the return, and from the entrance to the Beardmore Glacier, the maximum weight of food/fuel after initial collection was 56.4 ℔. That is roughly 13.4% of the weight of the same food/fuel dragged in the opposite direction. That meant, and offered to Captain Scott, a *contingency plan*: the company of four was able with *sustained velocity* (10.1 miles/day) to drag 421.4 ℔ of consumable provisions in addition to the weight of non-consumable items (sledge, tent, *etc*.).

Now let us look at the sledging efficiency of Captain Scott's party, assuming the above and assuming that at the first instance of health problems or incapacity of pulling the sledge, each explorer (P. O. Evans, Captain Oates and Captain Scott) was sitting on the sledge and was dragged by the remaining healthy companions. The result of such analysis is depicted on Fig. 11.19.

Let us look closely at this figure, which must be understood as a favorable scenario. On Feb. 7th, the first column on the figure, the party arrived at the Upper Glacier Depôt and collected food/fuel. Two days later, 35 ℔ of geological specimens were collected, and the party continued sledging down the Beardmore Glacier at below 20% of maximum sustainable efficiency. On Feb. 17th, P. O. Evans is ordered by Captain Scott to sit and ride on the sledge, and the party continues at 50% to 60% of sledging efficiency until the death of P. O. Evans on Feb. 17th, 1912. One must notice at this moment that from Feb. 7th (97th sledging day) through Mar. 6th

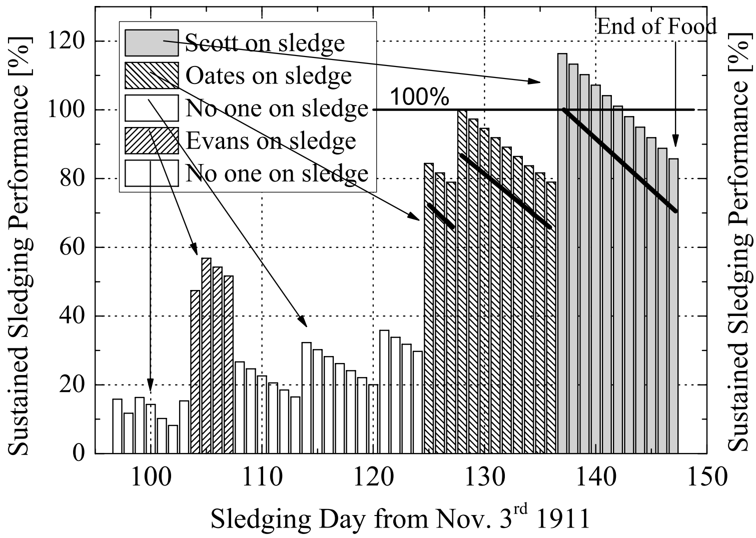


Figure 11.19. Actual and imaginary sledging efficiency of the party *vs*. sledging day comparison from the day (97th, Feb. 7th) when the party arrived at the Upper Glacier Depôt. In these calculations, the following weights of non-consumable items were assumed: (1) equipment and outfit = 0 ℔ [*sic*]. Neglecting frost accumulation, this weight was constant and it is assumed to be a baseline = 0; (2) food/fuel ration per man, per day = 2.15 ℔; (3) P. O. Evans' weight = 170 ℔; (4) Captain Oates' weight = 158 ℔; (5) Captain Scott's weight = 153 ℔.[1] The two time frames with empty white columns indicate when the party was in full sledging capacity and this is the baseline sledging efficiency. The time frames with crossed and grey filled columns indicate the time and sledging efficiency if P. O. Evans, Captain Oates, or Captain Scott were riding on the sledge. These represent imaginary sledging efficiencies *if and only if* sledge riding was done by incapacitated comrades. The thick black lines indicate the sledging efficiency of Dr Wilson and Lt Bowers while Captain Scott was riding on the sledge and the geological specimens were deposited on the Barrier for later recovery.

[1] One has to keep in mind that in these calculations, the body weights of P. O. Evans, Captain Oates, and Captain Scott were assumed as an upper bound, at about 5% less than their initial weights of 180 ℔, 165 ℔ and 161 ℔, respectively (Michael A. Stroud, *Nutrition and Energy Balance on the Footsteps of Scott's Expedition*, Human Nutrition: Applied Nutrition **41A**(1987)426–433). See also table titled Apr. 24th, 1911, in Griffith Taylor, *With Scott: The Silver Lining*, Smith, Elder and Co., London, 1916, *cf.* p. 225.

(125th sledging day), even if P. O. Evans was riding on the sledge, the party of four was dragging the sledge at a summary maximum sustainable sledging efficiency of 26.6%. Confronting "We could have come through had we neglected the sick" with in this figure raises objections and seriously challenges Captain Scott's account. Even if P. O. Evans was riding on the sledge, the party would drag the sledge at mere 26.6% efficiency (ability). This recent additional observation confirms my previous critique of Captain Scott's actions on Feb. 17th, when the party in a superficial sledging rush *abandoned* P. O. Evans.

After P. O. Evans' death on Feb. 17th, the party continues at a leisurely efficiency of 25 to 35%. On Mar. 6th, Captain Oates is ordered to sit and ride on the sledge, and

the party continues its northward track. This time, the labor of a three-man party is approaching its maximum performance (efficiency) only on one day, Mar. 9th, but the additional food left after P. O. Evans' death, and more pony meat from Shambles Camp and north of it, are certainly helping.

The next day after Captain Oates' death on Mar. 17th, 1912, Captain Scott realizes that "My right foot has gone, nearly all the toes," and decides to ride the sledge. On that day, and in order to sledge with Captain Scott riding on the sledge, the two remaining comrades, Dr Wilson and Lt Bowers, have to sledge at performance exceeding 100%, however only for 6 days. After that, due to diminishing food/fuel rations weight, their required performance drops below 100% performance.

It is evident from the above scenario that even with an incapacitated comrade, the remaining explorers could carry them to safety on the sledge, with performance not exceeding or only briefly exceeding its maximum. Let me recall here that all the authors who published historical accounts of this journey were trying to gain insight into the last days of Captain Scott's party, and particularly to find insight into Captain Scott's account of his last days

> [Wednesday[176], Mar. 21st.] Got within 11 miles of depot Monday night; had to lay up all yesterday in severe blizzard. To-day forlorn hope, Wilson and Bowers going to depot for fuel.
>
> [Thursday, Mar. 22nd and 23rd.] Blizzard bad as ever Wilson and Bowers unable to start to-morrow last chance no fuel and only one or two of food left must be near the end. Have decided it shall be natural we shall march for the depot with or without our effects and die in our tracks.
>
> [Thursday, Mar. 29th.] Since the 21st we have had a continuous gale [*sic*] … Every day we have been ready to start for our depot 11 miles away, but outside the door of the tent it remains a scene of whirling drift.

For the first readers, indeed a touching account. However, we are not the first readers, and we know from Chapter 8 that Captain Scott fabricated the duration and likely fabricated the existence of a gale allegedly taking place from Mar. 21st through Mar. 29th. Fig. 11.19 independently confirms that if the party was willing to fight for their lives, they could take a number of measures including carrying sick fellow explorers on the sledge. The burden of carrying an incapacitated comrade on the sledge would not exceed the party's performance. Additionally, the party could have lightened the load by dealing with the geological specimens as described in section 9.3, and after reaching the line of marker cairns beginning at the Mid Barrier Depôt on Mar. 1st, 1912, they could have immediately jettisoned the unnecessary theodolite. Yet the theodolite was only jettisoned around Mar. 17th, 1912, over two weeks after the party could have safely gotten rid of it to save weight. Taking such measures would not necessarily save their lives, but they *would* support the notion that Captain Scott, Dr Wilson, and Lt Bowers were willing to return to Hut Point/Cape Evans. Therefore, Captain Scott by writing, "We could have come through had we neglected the sick" produced an aesthetic fallacy (see also section 12.3).

Despite dumping certain items, it is telling that Commander Evans noticed and reported in a Feb. 6th, 1913 letter to Ralph Gifford[177]

> It seems to me extraordinary that in the face of such obstacles they stuck to all their records and specimens. We dumped ours at the first big check. I must say I considered the safety of my party before the value of the records and extra stores – not eatable.
> Apparently Scott did not. His sledge contained 150 lbs of trash. He ought to have left it, pushed on & recovered the specimens & records this year.

Commander Evans recognized the validity of my Scenario I, as described in section 9.3. Interestingly, he used sheer nonsense to publicly reject the validity of Scenario I the very next month, in an interview he gave to a New Zealand newspaper[178]

> Taking into account the climatic conditions, it is very doubtful, had the specimens and records been placed in any of the depots, that they would all have been recovered, and in that case the value of Captain Scott's journey would have been very much diminished.

Clearly, Commander Evans knew more than he would publicly let on.

What bothers me in Captain Scott's writings is his obscure representation of events. Indeed, it sounds convincing that incapacitated fellow explorers could slow down the party, any party. However, *Captain Scott never says in any of his writings that after ordering P. O. Evans to ride on the sledge the party found it impossible to sledge forward*. If Captain Scott was ready to make such a comment, it would prompt analytically-minded readers to wonder why P. O. Evans' weight was such a burden to the remaining party if the burden represented only 55–40% of sledging efficiency.

Additionally, Captain Scott is producing a bombshell that the party "could have come through had we neglected the sick". To use Captain Scott's famous words, "what does it all mean?" If they neglected and left P. O. Evans on the Barrier, how much faster they could possibly sledge? If they neglected Captain Oates or if he committed suicide at an early stage of his health problems, how much faster they could sledge? Does Captain Scott suggest that if he neglected the sick, his own foot would not be frostbitten right after Captain Oates' death?

One could add a few questions. However, the point is that while writing to Sir Francis, Captain Scott could not simply resort to his previous false accounts, and he felt obliged to produce a further fallacious argument to substantiate his journey to the South Pole and subsequent failure to return.

Worst of all, Captain Scott stated that my Scenario I was valid in a note he left in his last notebook, but implicitly rejected it by his actions: "Diary can be read by finder to ensure recovery of Records etc. but Diary should be sent to my widow."[179]

11.1.14. Route Marking and Depôt Laying

The landing point, or rather its forced selection, determined Captain Scott's route to the South Pole. In subsection 4.2.2, in conjunction with Dr Solomon's fallacies and fabrications, I described the reasons and sea-ice conditions at McMurdo Sound in 1910 which forced Captain Scott to land and establish a home base at Cape Evans,

instead of Cape Crozier or Hut Point. In reference to this, Dr Solomon formulated an additional fallacious observation[180]

> They opted to quickly base their camp at Cape Evans rather than at Cape Crozier or Hut Point, they were left a more difficult [*sic*] and longer route [*sic*] for the depot journey and similarly for the Pole in the coming year.

By taking the Corner Camp as a meeting point of two possible routes to be reached from Cape Crozier and Hut Point, I calculated that the route from Cape Crozier is actually 36 miles longer. One can subtract 10.7 miles to Cape Evans to get about 25 miles, which translates to more than two full sledging days. Not only was the route from Cape Crozier longer, but also more difficult as experienced during the *Winter Journey*, especially at Windless Bight.

Looking at the map of Antarctica available to Captain Scott, one can see that very little of its coastline was known in 1909. Consequently, Captain Scott could have considered three possible landing areas: the Bay of Whales, the Vahsel Bay, and the Ross Island area. However, since the Vahsel Bay was in the area of operations of the *German Antarctic Expedition* of 1911–1912, led by Wilhelm Filchner, Captain Scott naturally felt he could not select this place of landing. Lt Shackleton planned to land there during the *Endurance Expedition*.

Hence the Bay of Whales and Ross Island, or more generally the McMurdo area, were available. I presume that Captain Scott, like Lt Shackleton before on the *Nimrod Expedition*, judged that the Bay of Whales, which was a natural ice harbor, was an unstable ice formation. One has to remember that the Ross Island area was also unstable, and a dangerous place for landing and establishing a home base. After all, Mount Erebus was and still is the most active volcano in Antarctica. *Post factum*, we know that Mount Erebus was in no way threatening to Cape Evans or Hut Point, at least for the next 100 years. However back at the beginning of the twentieth century, no such knowledge about safety was available.

Returning to the main subject of this subsection, let me repeat that at the beginning of the twentieth century Ross Island was the only location to land an expedition. Cherry-Garrard felt obliged to respond to critics that several dozen miles (60 miles) could have been saved if Captain Scott landed at the Bay of Whales instead[181]

> Why, then, says the practical man, did we go to McMurdo Sound instead of to the Bay of Whales? Because we gained that continuity of scientific observation which is so important in this work: and because the Sound was the starting-point for continuing the exploration of the only ascertained route to the Pole, *via* the Beardmore Glacier.

Cherry-Garrard's response is wrong from many points of view. The actual theoretical distance shows that the Bay of Whales is about 2×43 miles closer to the South Pole. However, if Captain Scott was planning to follow Lt Shackleton's route, he would have known that he had to cross about 2×749 miles, as compared to 2×693 theoretical miles from the Bay of Whales if he went from the Bay of Whales to link up with Lt Shackleton's route at the Beardmore Glacier. Thus, the theoretical distance difference would have been 2×56 miles. Despite this, it is obvious that a good number of factors were unknown (stability of ice bay, state of Barrier surface near the

Bay of Whales, locations of valleys (glaciers) leading to the interior (Plateau?), *etc.*) to Captain Scott, and selection of a field-proven route was the best choice without the false argument of "continuity of scientific observation".

But what is "continuity of scientific observation," after all? To what natural phenomenon is Cherry-Garrard referring to in his continuity? Indeed, it is extraordinary that Cherry-Garrard, who according to himself could not figure out how to use a compass, explains Captain Scott's motives by appealing to science as an ultimate source of human judgment and reasons of actions. I can presume that continuity of studying the penguin's habitat in the McMurdo area may have represented some value. However, I can't think of any physical variables where continuity of observations were possible. Until permanent stations were established in Antarctica, no continuity of, for example, meteorological observations was assured. Here the continuity of measurement is understood in a climatological sense, using 30 years of measurements. In this sense, meteorological measurements made by all expeditions of the Heroic Age were minute records, and only mere pointers of what could be expected in the McMurdo area or along the route to the South Pole. This fact was clearly pointed out on Fig. 3.13, where Dr Simpson's *weather based* estimations of the Barrier temperatures were compared with a climatological one. In no way did both Captain Scott's and Lt Shackleton's expeditions represent "continuity of scientific observation". Besides we know from Tab. 1.1 that the public and scientific community did not care about Antarctic meteorological data, as their publications dragged on for many years without financial support. Cherry-Garrard produced a false dilemma (fallacy of false choice) and explained it by proposing the notion of a non-existent continuity of scientific observation.

Finally, while appealing to science and scientific research (observations), Cherry-Garrard ignored Captain Scott's actions to prohibit Lt Shackleton from using the McMurdo area during the *Nimrod Expedition*. McMurdo Sound and Ross Island was, according to Captain Scott, his private playground when he explained to Lt Shackleton[182]

> I feel I have a sort of right to my own field of work, anyone who has had anything to do with exploration will regard this region primarily as mine.

It appears that Captain Scott believed so. But then, how come Captain Scott was sledging across the Beardmore Glacier, discovered and named by Lt Shackleton after his expedition's biggest sponsor? The selective ethics of Captain Scott was striking and un-scientific, since for example the research on gravity and use of apples does not belong solely to Isaac Newton, Nicolaus Copernicus, Johannes Kepler, or anyone else.

It is often perceived that Captain Amundsen's route marking and general depôt distribution along the route to the South Pole was superior to Captain Scott's equivalent arrangement. However, this understanding resulted from, for example, selective citations, like in the case of Roland Huntford who commented[183]

> They were running out of food again. With enough for three and a half days, they left the mid-glacier depot on February 13th, but in Scott's words, "We don't know our distance from the next depot … We are pulling for food … We have reduced food, also sleep; feeling rather done."
>
> The uncertainty, and the brutal evidence of Scott's recklessly incompetent preparations were enough to try men in full possession of their faculties.

The first paragraph of Huntford's comment above is indeed horrifying for the unprepared reader, and reconfirmed by the second paragraph. Captain Scott must have been a fool and entirely incompetent as his party was short on food and he didn't know where he was. However, by cutting short the original journal entry, Huntford distorts the actual meaning and presents him in an unfavorable light. The relevant entry in Captain Scott's journal on Feb. 15th, and not on Feb. 13th as Huntford suggests it is, reads

> [Thursday, Feb. 15th.] … Again we are running short of provision. We don't know our distance from the depot, but imagine about 20 miles. Heavy march – did 13¾ (geo). We are pulling for food and not very strong evidently. In the afternoon it was overcast; land blotted out for a considerable interval. We have reduced food, also sleep; feeling rather done. Trust 1½ days or 2 at most will see us at depôt.

Comparing the original wording with Huntford's wording, it is evident that Captain Scott knew his location with sufficient accuracy and by no means was lost at the Beardmore Glacier (see also subsection 11.1.5). Captain Scott's estimation to arrive at the next depôt (Shambles Camp/Lower Glacier) in 1½ or 2 days was fairly accurate as the next depôt was reached late on Feb. 17th.

Another matter related to the above citations is that Huntford, with a little effort, could have found the distance sledged by the Captain Scott party as depicted on Fig. 11.9, as well as food/fuel rations available as presented in section 9.4 and subsection 11.1.10 to find out if Captain Scott was cheating.

Captain Amundsen – contrary to Captain Scott – was often prized on his elaborate scheme of marking his depôts and route between them. Indeed, the following comments may impress one and support the notion of the superiority of Captain Amundsen's methods[184]

> In the case of the first depot, at 80°S., we drew an imaginary east-and-west line through the depot and on this line set up flags on bamboo poles at intervals of approximately nine hundred yards, for a distance of about five miles on either side of the depot. This device would be an extra safeguard when we should make our way southward to the Pole or as we struggled back northward from it, protecting us in the case we got off course. Instead of one solitary marker at the depot itself, there would be drawn across our path a series of markers along a line ten miles long, close enough together so that we would almost certainly see one of them. We even marked the flags so that when we should come across one of them on the journey we would know to which side of the depot we were. This would reduce by half the time spent in finding the depot.

Recalling also that almost all of Captain Amundsen's route between Framheim to the first depôt at 80°S was "marked … with bamboo poles surmounted by flags, set up at such intervals that from any flag the next one could be perceived in the distance." One may be indeed impressed with Captain Amundsen's safety measures and margin. However, how Captain Amundsen figured that his markings "would reduce by half the time spent in finding the depot" will remain unanswered.

Despite this, Captain Amundsen's account of route marking and depôt laying was clear and well evidenced. One cannot say the same about Captain Scott's *Terra*

Nova Expedition. Scant information is present in Captain Scott's and his fellow explorers' accounts. Lt Shackleton, who pioneered the route to the South Pole from Ross Island, established a chain of depôts called by him Depôt **A** (Nov. 14^{th}), **B** (Nov. 18^{th}), **C** (Nov. 28^{th}), **D** (Dec. 7^{th}), **E** (Dec. 17^{th}) and **F** (Jan. 8^{th}).[185] Captain Scott's One Ton Depôt and, for example, Lower Glacier Depôt, were located in the proximity of the former Lt Shackleton Depôts **A** and **D**.

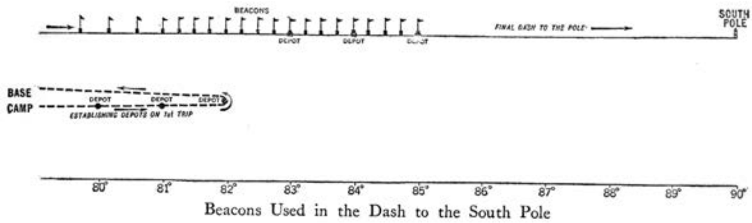


Figure 11.20. Captain Amundsen's original illustration of his beacons used to mark the route between depôts.[1]

1 Roald Amundsen, *My Life as an Explorer*, Doubleday, Page and Company, Garden City, 1927, *cf.* p. 251.

I have been intrigued for a good time with what was wrong in Lt Shackleton's calculations of food/fuel rations, which proved to be short by $2 \times 97.5 = 195$ miles, which translates into say 20 sledging days. Since he was sledging with four men, one can fairly say that Lt Shackleton was short of about 3 of Captain Scott's X.S. rations. However, Lt Shackleton's error was due to his *untested* assumption of a sledging duration of 93 days, which gives ~16 miles/day of sustained velocity. It is entirely puzzling how Lt Shackleton arrived at this figure.

Comparing to Captain Amundsen, Captain Scott was much less descriptive and elaborate about his precautions related to route and depôt marking. All, Captain Scott's depôts were marked with a cairn, a black – and in one case (1½° Depôt) – red flags. It is not clear if at every daily stop the party constructed a cairn. It is also not clear if during the Barrier stage those walls were constructed at every stop to shelter ponies.

However, despite all of these uncertainties, one thing is certain. All parties never missed a depôt, and never got lost. Several factors played a role, but chiefly well defined and simple navigation methods as I discussed in subsection 11.1.5 were sufficient.

11.1.15. Summary

This subsection was originally titled *The Causes of the Disaster* and was intended to investigate as many causes as possible for Captain Scott's failure to reach the South Pole before Captain Amundsen and safely return to Cape Evans/Hut Point. However, after working on its content I realized that the title of this subsection must be changed to *The Causes of the Disaster-Rebuttal*.

It was Captain Scott who coined the term "The Causes of the Disaster". It was him who, in his *Message to the Public*, listed and briefly discussed several causes of his own failure. Later on, various authors added their own more or less important findings accounting for Captain Scott's death. Some of these accounts were merely a David Copperfield trick of pulling rabbit after rabbit from an empty hat.

All conjectures and causes listed by Captain Scott, as well as additional causes proposed by different authors, are not found to be substantiated for the reasons discussed above. In the following section 11.3, I will review the weather-related causes of the disaster.

To finish the summary of this section, let me just point the main results related to the possible causes of Captain Scott's disaster analyzed in the current subsection. In the following section 11.3, additional analyses of weather events and food/fuel shortages related to the causes of disaster will be reviewed.

The conclusions of the current section analysis are as follows:

1. *The Loss of Ponies in March 1911* – Captain Scott's conjecture between party disaster and the loss of ponies in March 1911 is entirely unfounded. The number of ponies which survived and were used for transportation of goods during the *South Pole Journey* was entirely sufficient,
2. *(79°28½'S, 170°E)* – Nothing was mysterious about the location of One Ton Depôt. All parties, except Captain Scott's, reached the location while sledging on full food/fuel rations. The actual location of Captain Scott's last camp was 22 miles from One Ton Depôt,
3. *Complexity of Transportation Methods* – During the *South Pole Journey*, for most of the distance man-hauling was used as transportation. Additionally, ponies and dogs did their job accordingly, at least until the dogs were misused due to the mutiny at Cape Evans/Hut Point,
4. *Misuse of the Dog Team* – Captain Scott's indirect use of dogs was actually careful and attentive. His written orders to Meares issued well before the *South Pole Journey* were correct and sound, though his orders for what should be done if Meares was late to return leave much to be desired. Captain Scott's management of the dogs during the actual journey was also right. In no way was Captain Scott responsible for dog team misuse after their return from the initial leg over the Barrier,
5. *Navigation and Navigation Methods* – The navigation methods used by Captain Scott were more than adequate. In particular, his orders to learn compass navigation and keeping a track of declinations between depôts were a time-saving procedure, and a practical field navigation method,
6. *Gale at 83°S* – Although this particular 4-day blizzard was a nasty meteorological event which delayed the party, after its end the Captain Scott party sledged to and back from the South Pole on full food/fuel rations,
7. *Soft Snow at Beardmore Glacier* – These snow conditions and thus sledging conditions presented a challenge to the Captain Scott parties. However, the weather is a variable by its nature and false expectation of fine conditions is ill advised.

8. *The Fifth Man* – Addition of Lt Bowers to the final Pole party did not delay Captain Scott's and Lt Evans' party. Captain Scott's management of food rations after taking on Lt Bowers represents a logistical masterpiece,
9. *Fuel Leakage* – The fuel leakage recorded from February 1912 onward represented only a mere ~10%, and thus it did not contribute in a meaningful way to the disaster,
10. *Food shortages* – Food shortages reported by Captain Scott during the party's descent of Beardmore Glacier and sledging across the Barrier did not occur,
11. *Collecting and Hauling Geological Specimens* – The weight of collected specimens was initially rather small compared with the weight of collected gear and rations at each depot, but would have become proportionally heavier as they travelled further from the previous depôt,

Figure 11.21. The demoralized Captain Scott party at the South Pole (Captain Oates, Captain Scott, P. O. Evans and seated Lt Bowers, Dr Wilson). While looking at this picture, the investigative reader may notice a strange image of Captain Amundsen's face on P. O. Evans' left leg! Captain Amundsen's eyebrows, eyes, nose and distinctive mustache with beard are clearly imprinted and visible.

12. *Vitamin Deficiency* – Modern research shows that almost certainly all of the members of Captain Scott's party suffered in different degrees in various vitamin deficiencies, in particular, vitamin C deficiency with scorbutic symptoms, including fatigue. Towards the end of March 1912, Captain Scott, Dr Wilson, and Lt Bowers were unquestionably, in individual different degrees, affected by scurvy,

13. *Neglecting the Sick* – The consideration of neglecting or not neglecting comrades by Captain Scott was a pointless notion, because One Ton Depôt would not be a salvation location. The party, regardless of how many people were still alive, would have perished on arriving this depôt or not long after. Because of negative sustained sledging velocity starting from the descent of the Beardmore Glacier, it was not possible to reach Cape Evans at any reasonable time,

14. *Route Marking and Depôt Laying* – All arrangements per route marking, depôt laying and marking were entirely satisfactory despite being inferior to Captain Amundsen's. Captain Scott, as well as the First and the Second Return Parties, never missed or failed to locate a depôt.

Wrapping-up the current section, one can conclude that the causes of the Captain Scott disaster (death) did not in a meaningful and/or additive way contribute to his and his comrades' deaths. One must also understand that Captain Scott was not on a leisure journey to the Pole. It was an extremely demanding exploratory journey, both mentally and physically, and Captain Scott was Faulkner's "the sum of his misfortunes".[186]

Unquestionably, all physical and mental issues during the *South Pole Journey* were entangled and dependent on each another in a complex way. Some of the reasons mentioned above weakened the party's strength, particularly vitamin deficiency (in particular those (point 1, 7 and 8) listed by Captain Scott in his causes of disaster). However, these were in no way causes of the disaster.

11.2. The Two Black Flags Axiology

Had I but died an hour before this chance,
I had lived a blessed time; for, from this instant,
There's nothing serious in mortality:
All is but toys: renown and grace is dead;
The wine of life is drawn, and the mere lees
Is left this vault to brag of.

William Shakespeare[187]

On Jan. 15th, 1912, after Lt Bowers' careful measurement of the party location, 89°26′57″, Captain Scott prophetically commented in his journal

> It is wonderful to think that two long marches would land us at the Pole. We left our depôt to-day with nine days' provisions, so that it ought to be a certain

> thing now, and the only appalling possibility the sight of the Norwegian flag forestalling ours … Only 27 miles from the Pole. We *ought* to do it now.

The next day, Captain Scott in an apparently upbeat mood continued

> We marched well in the morning and covered 7½ miles. Noon sight showed us in Lat. 89°42′ S., and we started off in high spirits in the afternoon, feeling that to-morrow would see us at our destination.

Up to this point, reaching the South Pole was the only objective for Captain Scott and his companions. After so many days of sledging, passing Lt Shackleton's *Furthest South* mark, they could almost see it. The Pole was in their grasp. The victory was within a mere two sledging days. However, on this day, Jan. 16th, 1912, Captain Scott described in his journal

> About the second hour of the march Bowers' sharp eyes detected what he thought was a cairn; he was uneasy about it, but argued that it must be a sastrugus. Half an hour later he detected a black speck ahead. Soon we knew that this could not be a natural snow feature. We marched on, found that it was a black flag tied to a sledge bearer; near by the remains of a camp; sledge tracks and ski tracks going and coming and the clear trace of dogs' paws – many dogs.

Slowly, as they sledged closer and closer to what after a while clearly became recognizable as a sinister black flag, the entire party's mood changed instantly

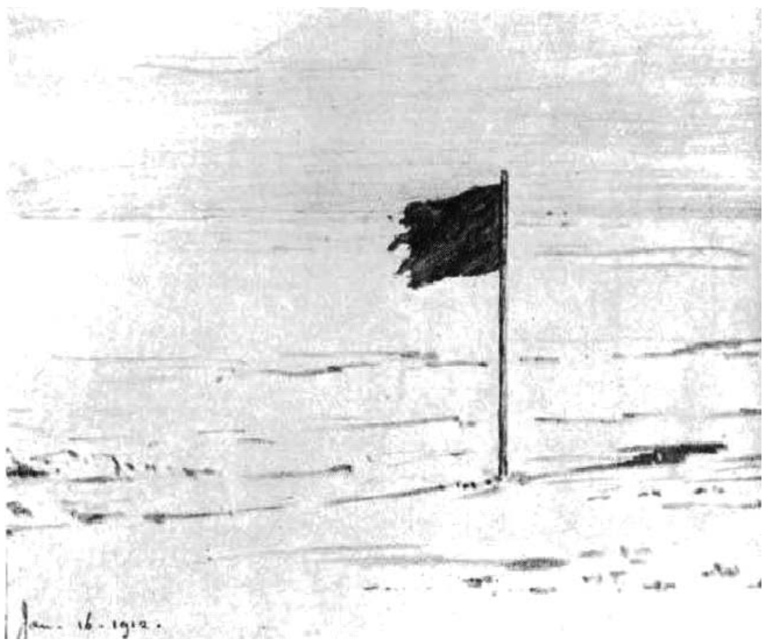


Figure 11.22. Norwegian flag 1, close to Captain Scott's Camp #68.

> This told us the whole story. The Norwegians have forestalled us and are first at the Pole. It is a terrible disappointment, and I am very sorry for my loyal companions. Many thoughts come[188] and much discussion have we had. To-morrow we must march on to the Pole and then hasten home with all the speed we can compass. All the day dreams must go; it will be a wearisome return.

Their photograph in Fig. 11.21, taken at the South Pole, tells us "the whole story". They appear run-down and without the slightest glimpse of a genuine smile. Captain Scott's narrative was also changing, from his usual frame of mind of the strong and committed explorer to that of an introverted person not sure of his past and future plans.

The investigative reader, after reading Captain Scott's account, must wonder about the subject of "much discussion have we had" after finding the black flag.

On the next day, Captain Scott added the following comments in his journal

> The Pole. Yes, but under very different circumstances from those expected. We have had a horrible day …
>
> We started at 7.30, none of us having slept much after the shock of our discovery …
>
> Great God! this is an awful place and terrible enough for us to have laboured to it without the reward of priority …
>
> Now for the run home and a desperate struggle to get the news through first.[189] I wonder if we can do it.

And after finding a second black flag from Captain Amundsen's position fixing, Captain Scott summarizes

> Well, we have turned our back now on the goal of our ambition and must face our 800 miles [*sic*] of solid dragging and good-bye to most of the daydreams!

Indeed, Captain Scott had presumed his companions' mental state had dramatically and abruptly changed. Suddenly the return distance became 800 miles instead of the true distance of 749 miles, and the Pole location became "an awful place" vacated by "the daydreams". Just one day before seeing the first black flag, Captain Scott did not have any second thoughts about the possibility of returning safely to Hut Point, and the closest he had come was a vague questioning he made months prior.[190] Does one day of sledging in the 144-days scheduled plan make such a difference that Captain Scott started to "wonder if we can do it"? If that was the case, then should Captain Scott, like Lt Shackleton, have turned back before reaching the Pole? Evidently, Lt Shackleton was short of food and therefore turned back. However, equally evident was that Captain Scott was not short of food, as I have shown in Chapter 9.

Provided that Captain Scott kept his journal for posterity, it is quite surprising to read the above lines. It appears that Captain Scott was really devastated by the events. The investigative reader can readily notice a great difference between Captain Scott's description above, and his text given in the *Message to the Public*, which contains all elements of leadership and analysis of events. Instead of thinking and writing that the

Figure 11.23. Norwegian Flag 2, where Dr Wilson found Captain Amundsen's note "The Norwegian home Polheim/is situated in 89°58′S. Lat/SE by E (comp) 8 miles/15 December 1911/Roald Amundsen."

way back would be easy since the party mapped the route, including easy navigation due to recorded magnetic variations between depôts, on Jan. 19th Captain Scott writes

> I'm afraid the return journey is going to be dreadfully tiring and monotonous.

These accounts by Captain Scott reflected his mental state. However, can we observe that this obvious psychological downturn was somehow reflected in Captain Scott party's sledging efficiency? At a number of instances in this book, I analyzed sledging efficiency by looking at the sustained sledging velocity of the Captain Scott party and respective returning parties. Especially interesting and telling was a plot of the Captain Scott party's delay behind the schedule, as depicted on Fig. 11.9. A. Here, we are concerned with Captain Scott's performance right after the South Pole was reached and, therefore, part of the figure mentioned above is depicted on Fig. 11.24.

It is clear from Fig. 11.24 that despite the lack of "the reward of priority" at the Pole, the Captain Scott party was pushing homeward with unprecedented efficiency, with almost every sledging day gaining time over the 144-day schedule. The homeward effect? Not at all. The observed increase of sledging velocity after the Captain Scott party sledged to the South Pole with the Fifth Man resulted from the necessity of compensating for limited food/fuel rations by ensuring more frequent arrival times at the depôts (see subsection 11.1.8).

It is also illustrative to recast the fraction of days relative to the 144-days schedule into direct everyday distance sledged by the Captain Scott party. The result is depicted

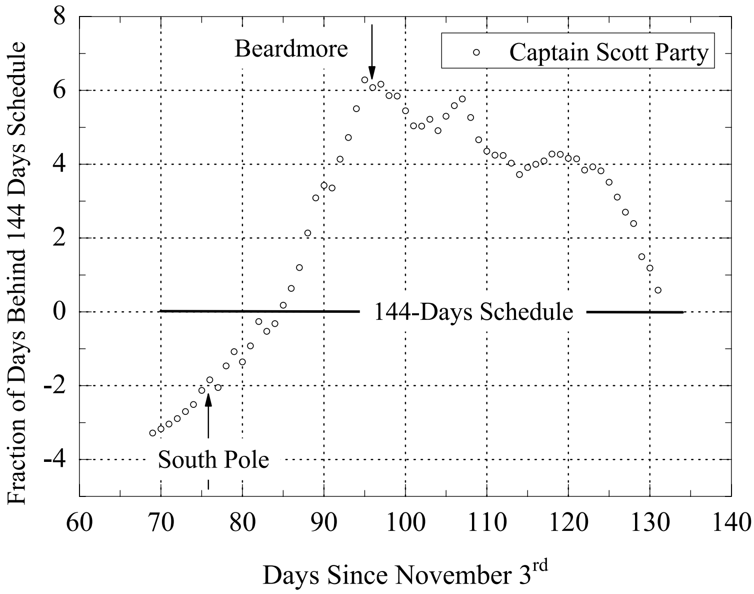


Figure 11.24. The fraction of days relative to the 144 days schedule of Captain Scott's South Pole party. The times of reaching the South Pole and Beardmore Glacier are indicated on the figure by black arrows.

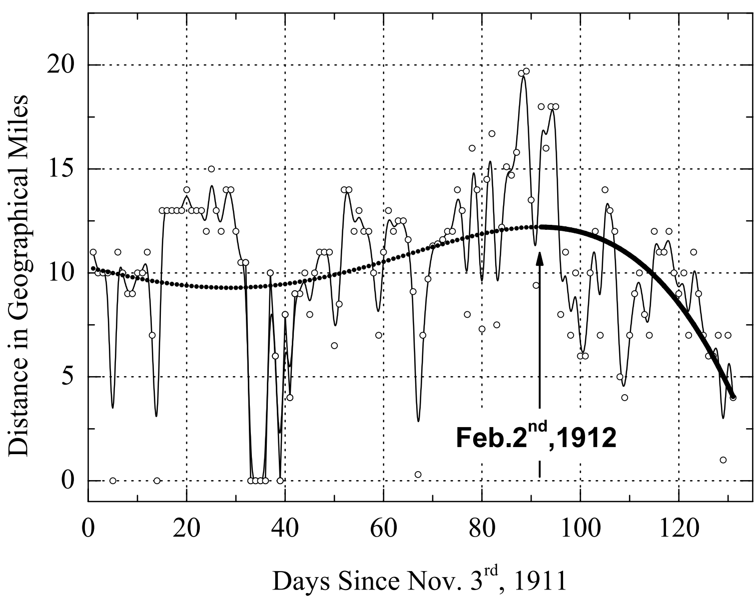


Figure 11.25. Sledged daily distance (○) of Captain Scott's journey to the South Pole and back. The black dotted line and black thick line represents a polynomial fit to the data points, to determine sustained sledging velocity, $v_s(t)$. Its first derivative $dv_s(t)/dt = 0$ for Feb. 2nd, 1912.

on Fig. 11.25. One can see that the daily distance sledged was ranged from zero, when the party could not move because the weather, up to almost 20 miles/day. However, by looking at these sledged distance fluctuations, one can search for the party's *sustained* sledging distance. The result is presented in the same Fig. 11.25 by a solid line, which represents a polynomial fit of daily sledged distances reported by Captain Scott. This figure supports previous findings that despite various deviations from the planned velocity, the Captain Scott party in the long run maintained its planned velocity.

Starting the South Pole assault from the foot of Beardmore Glacier, the party gradually increased its daily sustained velocity, until the party reached the upper glacier depôt on its way back from the South Pole to Hut Point. From that time, the 92nd sledging day (Feb. 2nd, 1912), the daily velocity of Captain Scott party was *systematically* and *steadily* decreasing. It is indeed surprising, since while sledging downhill along an already traversed route, the Captain Scott party moved slower than just several days before over the Plateau, or many days before when the heavy laden party was sledging up the Beardmore Glacier.

The overall progress of the Captain Scott party may be also approximated by moving the average of daily sledging distances. For obvious reasons, the daily sledging distance is not Gaussian distributed and failed, for example, the Shapiro-Wilk test. However, combined with the above methods, it can provide an approximate measure of the general tendencies in daily sledging distance (velocity). On Fig. 11.26, I depicted actual daily sledging distances and respective moving averages (MA). One more time, one can observe that the Captain Scott party, after a temporary setback in December due to the gale, was sledging with a fine velocity. Since the gale, the

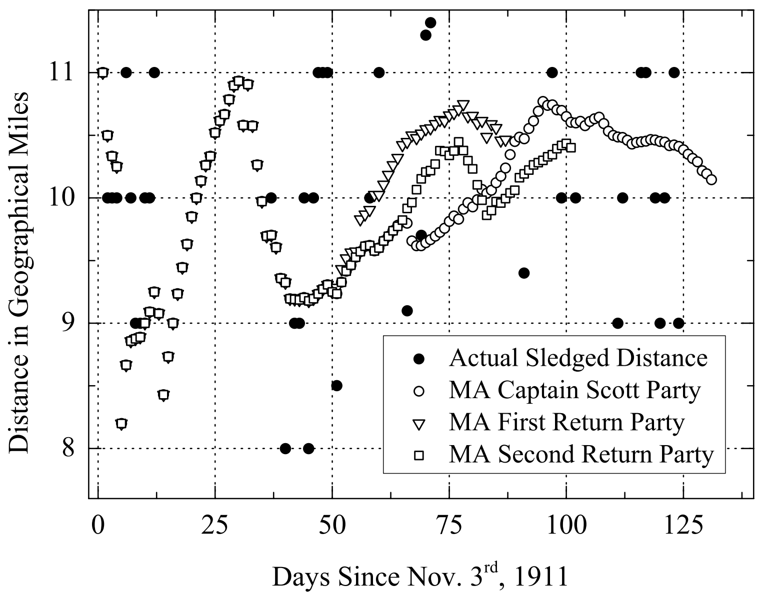


Figure 11.26. Daily sledging distance (●) and its moving average (MA) for the First Return (▽), Second Return (□) and Captain Scott (○) parties respectively. For better clarity, the ordinate is rescaled and only distances between {7.5–11.5} miles/day are shown.

party was daily increasing its sledging distance until the 92nd sledging day on Feb. 2nd. From that time, their progress became slower and slower.

The analysis above confirms and supports the previous findings, using a polynomial fit and the fraction of days behind schedule, that on or about Feb. 2nd, 1912, the Captain Scott party's sledging progress developed a steady negative gradient. This is rather formal, based on *sustained* sledging velocity or *trends* in Captain Scott's performance, inferring that from the beginning of February 1912 the party was falling off a cliff.

It is interesting at this juncture to consult Captain Scott's journal to find if the just mentioned *steady* negative gradient of sustained sledging velocity was reflected in his comments. After all, it was not a temporary sledging velocity setback; it lasted from Feb. 2nd to the very end. Let me stress here that we are speaking here about a large event – a steady sustained negative gradient of sledging velocity, which lasted about one and a half months; from Feb. 2nd until Mar. 21st, 1912, or 48 days, which represents ⅓ of Captain Scott's entire journey.

Realizing the size of this steady slowing down, one must inevitably wonder why Captain Scott, who was principally concerned with sledging velocity, did not add this event to his list of causes of the disaster in his *The Message to the Public*. Instead, Captain Scott found, for example, the entirely irrelevant loss of ponies in March 1911 (see subsection 11.1.1) to stand as one of the causes of the disaster.

Returning to Captain Scott's journal entries, one would search in vain for his account or description of worries about the steady decrease of sustained sledging velocity. Indeed, Captain Scott at several occasions from Feb. 2nd expressed his concerns of disappointment about low mileage (Feb. 11th, Feb. 20th, …). Equally, on several occasions like Feb. 2nd and Feb. 15th, Captain Scott was pleased with good mileage. Indeed, these records were acknowledged by Captain Scott, but these were just velocity fluctuations expected to crop up.

However, *sustained* sledging velocity is the velocity which is sustained over a long period of time, despite daily velocity fluctuations. The Fifth Man sledging plan was created to meet this issue, and later precisely executed by Captain Scott and the Second Return Party (see subsection 11.1.8). The Fifth Man re-arrangement additionally provides evidence that Captain Scott and for that matter the rest of the party, in particular Lt Bowers, were aware of the importance of sustained sledging velocity to achieve the journey's goal.

Despite this, Captain Scott remained enigmatically tacit for the entire period with the exception of Feb. 19th

> We have struggled out 4.6 miles in a short day over a really terrible surface it has been like pulling over desert sand, not the least glide in the world. If this goes on we shall have a bad time, but I sincerely trust it is only the result of this windless area close to the coast [*sic*] and that, as we are making steadily outwards, we shall shortly escape it. It is perhaps premature to be anxious about covering distance … I wonder what is in store for us, with some little alarm at the lateness of the season [*sic*].

At first glance, Captain Scott's above account may appear as sensible and representative of truthful concerns. However, this is not the case, since Captain Scott presents false concerns. A mere 4.6 miles on Feb. 19th represent just a temporary sledging distance, and indeed a very short distance. From the departure on Nov. 3rd, 1911, the

party had a number of days when the sledged distance was short or nil, like during the gale in December 1911. Despite these setbacks, the Captain Scott party was sledging forward, and the distance lost due to many different factors was re-gained on days when the party was sledging well above the 144-days scheduled velocity.

This was indeed a false concern by Captain Scott. In reality, he should have addressed the issue of, and thought in terms of, sustained velocity, just as he was thinking and acting during the Fifth Man rearrangement and its implementation. The investigative reader may readily notice the similarity of confusing sustained with temporary velocities, and climate with the weather. A combination of sustained and temporary velocities is a wrong notion.

On Feb. 19th, when Captain Scott suggested in writing that the party was in some obscure "windless area close to the coast," he was evidently engaging in a cherry picking fallacy. Let me recall that on Feb. 19th at Captain Scott's "windless area," his party was almost exactly, bar a few miles, at the same location it was on Dec. 5th – 8th the previous year when they were hit by the 83°S Gale (see subsection 11.1.6).

And Captain Scott's final concern of a "little alarm at the lateness of the season" on Feb. 19th, 1912 is also an entirely false concern, since he sledged according to his 144-days schedule, and on this day his party was about 4½ sledging days *ahead* of the original schedule. Captain Scott was not being clear. Is he saying that:

- The party was sledging too slow,
- The 144-days schedule was too long,
- Or the season was advancing too rapidly.

Without giving answers, it is obvious in the light of the previous chapters that Captain Scott is saying nothing that can be viewed as educated guesses or analyses. He just imports the word "season" from general knowledge, without being able to justify its meaning about the 83°S location at the Barrier in 1912. Instead, Captain Scott is plainly de-railing the investigative reader's thinking by pointing the finger at false concerns and issues.

On the contrary, the event which occurred during ⅓ of the journey time, the event which directly threatened the expedition, went apparently unnoticed and uncommented on by the party. Lt Bowers, who was the party's logistics man, suspiciously ceased keeping his diary at the Upper Glacier Depôt on Feb. 11th, 1912, if one believes Captain Evans, or Feb. 3rd if one believes recent historians.[191] Dr Wilson and Captain Oates ceased keeping their diaries on Feb. 27th and 24th, respectively. In all of these accounts, not a trace of worry to accompany the negative sustained sledging velocity can be found, not a word. Instead, one can find the whole range of difficulties, obstacles, mishaps and catastrophes.

Captain Evans, in his never read yet often cited book, while describing the Captain Scott party's return cites Lt Bowers' diary to illustrate the journey. While citing Lt Bowers' diary entries in quotation marks, Captain Evans adds his comments[192]

> "*January* 29.- Our record march to-day. With a good breeze and improving surface we were soon in amongst the double tracks where the supporting party left us. Then we picked up the memorable camp where I transferred to the advance party. How glad I was to change over. The camp was much drifted up, and immense sastrugi … etc."

> Day's marches, temperatures, and so on, then his diary commences missing days out and only contains two line entries in short, sharp notes such as:
>
> "*January* 31.- Picked up depot 11.20 a.m. Picked up my ski 6.15 p.m. No wind latterly-heavy surface. 13 1/2-Bill's leg – Evans's fingers – extra biscuits, etc."; and
>
> "*February* 11.-Very heavy surface-ice crystals-movement of upper currents-Evans cook-finer weather-lower temperature-sastrugi. Run 11.1."
> It was probably the beginning of the end [*sic*].

Indeed, it is remarkable how Captain Evans, based on the above coarse field notes of Lt Bowers, arrived at the judgment that the date of Feb. 11th "was probably the beginning of the end".

Captain Evans' book, from which the above account of "the beginning of the end" of the Captain Scott party is taken, was published many years after the *Terra Nova Expedition*'s return, and one may think that during this time he had gained special insight. However, right after the expedition's return, the then Commander Evans published in a July 1913 issue of the Geographical Journal the following comment about systematic sledging velocity decrease[193]

> Seaman Evans' death took place on February 17, and then the bereaved little band pushed northward with fine perseverance, although they must have known [*sic*] by their gradually [*sic*] shortening marches that little hope of reaching their winter quarters remained.

It is evident from Commander Evans' description that he expected that "they must have known" that their marches on the Barrier, and as I additionally showed, during the Beardmore Glacier descent were "gradually shortening". Indeed during ⅓ of the entire journey, Captain Scott sledged with a negative velocity gradient.

For Commander Evans, a systematic sledging velocity decrease for ⅓ of Captain Scott's entire sledging journey begged for explanation, and he continued[194]

> Their best march on the Barrier was only 9 miles [*sic*], and in the later stages their marches dropped to 3 miles. The depôts were 65 miles apart, contained six weeks' provisions; they knew their slow progress was not good enough, but they could not increase their speed over such bad surfaces. The temperatures fell as they advanced, instead of rising as expected [*sic*], and we find them recording a temperature of –46.2 one night.

While trying to justify Captain Scott, Commander Evans is incorrect in one minor and one major count. The best marches of the Captain Scott party during the barrier stage were on Feb. 25th and 28th, when the party sledged 12 miles on each of these days, and not 9 miles as he suggests. He also continues to justify "bad surfaces" by saying that "the temperatures fell as they advanced, instead of rising as expected". Of course, Commander Evans could not know and prove that Captain Scott forged his weather data in the crucial time of late February and March 1912. However, Commander Evans' suggestion that temperatures should increase as the Captain Scott party sledged northward is counterfactual and does not follow the sound and simple reasoning based on the evidence available to him in 1913.[195] The only consolation

is that he corrected his minor error of 9 miles instead of 12 in his last book, which he finished shortly before his death.[196]

Commander Evans' comment about expectations of rising temperatures was strongly echoed years later, when Dr Solomon came with her revelatory fabrications and fallacious thinking.

Interestingly, and equally surprising, is the comment of our unfavored fellow explorer Cherry-Garrard, who comes to assist Commander Evans by making comments out of nothing, right after ending his description of the sledging of the Captain Scott party on Feb. 14th [197]

> There was something wrong [*sic*] with this party: more wrong [*sic*], I mean, than was justified [*sic*] by the tremendous journey they had already experienced. Except for the blizzard at the bottom of the Beardmore and the surfaces near the Pole it had been little worse than they expected. Evans, however, who was considered by Scott to be the strongest man of the party, had already collapsed, and it is admitted that the rest of the party was becoming far from strong. There seems to be an unknown factor [*sic*] here somewhere [*sic*].

Indeed, from the beginning of February, all previous events and accounts of Captain Scott and his fellow explorers show a complex but coherent picture of the party sledging to and from the Pole. This complex picture involves the usual fluctuation of events; good and bad surfaces, the windy and windless times, mild and low temperatures. But at the beginning of February 1912, these apparent random fluctuations of Captain Scott's fortune changed. The change was, however, one-sided. Gradually, day by day, Captain Scott's narrative gets more and more creepy. It appears that the beginning of February marks an artificial turning point in Captain Scott's story. Gradually, the victorious and efficient expedition, due to the convergence of more and more dramatic events, is changing into a heroic struggle against elements and individual weaknesses.

I find it very strange that *Terra Nova Expedition* book authors never read but often cite Commander Evans' book, never read but occasionally cite his February 1913 letter to Ralph Gifford, and that they never noticed Lt Evans' 1913 statement about Dmitrii's willingness to go further south, his 1936 speech to the RN hospital or his final revelation about Captain Scott's thinking on Jan. 3rd, 1912. I wonder about their neglect of Edward Ratcliffe Garth Russell "Teddy" Evans, a fascinating man who was impulsive and prone to factual slip-ups, but who also possesses valuable insights for anyone who looks hard enough.

In the previous subsection of the current chapter, I enumerated and discussed all possible factors which, according to Captain Scott himself and various authors, were responsible or significantly contributed to the disaster and the ultimate deaths of the party. Indeed, there is no question that some of these factors may have impaired the Captain Scott party's physical strength. It is likely that these factors, combined with normal civilized men's needs like security, everyday life comforts, *etc.* even more depleted the original strength of the party. However, Captain Scott's journey to and from the South Pole was not leisure tobogganing – it was in all aspects an exploratory adventure.

11.3. Surprises which did not Await Captain Scott on the Barrier

I had noticed that I had no difficulty conversing with robots, because absolutely nothing surprised them. They were incapable of surprise. A very sensible quality.

Stanisław Lem[198]

This section, although in the chapter entitled *Captain Robert F. Scott: An Apology*, does not exactly follow the meaning of *apology* – as defending something that other people criticize. It is rather designed to repeat in a summary way of what did not await Captain Scott on the Barrier. The word "await" is sarcastically borrowed from Captain Scott's celebrated *Message to the Public*, which in view of my previous analyses and results is an entirely counterfactual statement as a summary of the *South Pole Journey*. Yet according to some like Stephen Pyne, the words of the *Message to the Public* "claim the status of moral epistle. They are meditations on character, on how one faces death"[199] and how one describes the "moral landscape" of Antarctica.

Before looking at the "moral landscape" of Captain Scott's *Terra Nova Expedition*, it is first much more appropriate and interesting to digitize the related issues with which to base an educated analysis on the moral topography of expedition.

Let me begin this section with a lengthy citation from Captain Scott's *Message to the Public*

> But all the facts above enumerated were as nothing to the surprise [*sic*] which awaited us on the Barrier. I maintain that our arrangements for returning were quite adequate [*sic*], and that no one in the world would have expected [*sic*] the temperatures and surfaces which we encountered at this time of the year. On the summit in lat. 85° 86° we had –20°, –30°. On the Barrier in lat. 82°, 10,000 feet lower, we had –30° in the day, –47° at night pretty regularly, with continuous head wind during our day marches. It is clear that these circumstances come on very suddenly, and our wreck is certainly due to this sudden advent of severe weather, which does not seem to have any satisfactory cause. I do not think human beings ever came through such a month [*sic*] as we have come through, and we should have got through [*sic*] in spite of the weather but for the sickening of a second companion, Captain Oates, and a shortage of fuel in our depots for which I cannot account, and finally, but for the storm which has fallen on us within 11 miles of the depot at which we hoped to secure our final supplies [*sic*]. Surely misfortune could scarcely have exceeded this last blow. We arrived within 11 miles of our old One Ton Camp with fuel for one last meal and food for two days. For four days we have been unable to leave the tent the gale howling about us.

I ask the investigative reader to critically read Captain Scott's above account a few times to appreciate its content. Thinking about this part of the *Message*, not only in terms of digits but also in terms of its logical construction, the investigative reader can readily notice several pertinent issues not mentioned in the previous subsections.

Clearly, Captain Scott wanted to derail the reader's natural thinking. Evidently, Captain Scott was "surprised" by the weather which "awaited" them on the Barrier.

Indeed, "no one in the world would have expected" such low temperatures" and a "head wind during day marches" and all of this apparently lasted "a month". But even then, regardless of all that, they "should have got through" except for the sickening of Captain Oates, a shortage of fuel, and "the storm which has fallen on us" 11 miles from One Ton Depôt where they "hoped to secure" their "final supplies".

Without going further, the investigative reader may readily notice that indeed Captain Scott in his account committed the familiar mistake of equating weather with climate by being "surprised" with the weather after reaching the Barrier. Clearly, Captain Scott had a feeling that the weather was unexpected and unusual. However, since no one before (or long after) Captain Scott's party had reached the Barrier at this time of the year, how could Captain Scott be "surprised" by the weather? Captain Scott's "surprise" was an entirely uneducated observation. Evidently, Captain Scott may have felt the need to justify his "surprise" by mentioning temperature differences between the summit (Antarctic Plateau) and the Barrier. Yet again, Captain Scott confuses both time and the notion of lapse rate, as I will explain in subsection 11.3.3. However, by comparing temperatures at different locations, Captain Scott envisioned a key feature of temperature changes along his route from the Pole. This feature is that there is an unspecified relationship between temperatures recorded at different locations. In Chapter 7, I have explored this relationship while performing neural network simulations to discover a link between minimum near surface daily temperatures along Captain Scott's route.

However, Captain Scott was in no position to make an educated guess of climatological temperatures on the Barrier at particular locations, and on a given time of year. Many authors, and in particular Dr Simpson and Dr Solomon, provided ammunition to convince the public that meteorological events reported by Captain Scott were indeed surprising. The investigative reader may recall from Chapter 4 how forcefully and unethically Dr Solomon was trying to persuade the readers that the weather and climatological conditions were allegedly understood by Captain Scott with the help of Dr Simpson. All of Dr Solomon's fallacies were produced to support the notion that indeed the weather conditions reported by Captain Scott were entirely unexpected and unprecedented[200]

> Scott and Simpson had every reason to believe, based upon their hard-won experience and careful measurements during journeys in every season, that the Barrier temperatures in March would be about twenty degrees colder than at Cape Evans. This meant that the last stage of the polar journey on the Barrier should be expected to take place in challenging but endurable temperatures averaging near –20°F.

In Chapters 3 and 4, I described in great detail why and how Dr Solomon, and before her Dr Simpson, produced fallacious meteorological deductions. At no instance back in 1911/1912, due to nonexistent "hard-won experience", were Captain Scott or Dr Simpson in a position to arrive at educated estimations of meteorological conditions on the Barrier during the months of February and March. There was simply no data worthy of the name, and we had to wait a long time to gain insight into the nature of the meteorology of the Barrier.

However, not everyone was satisfied with Captain Scott's explanations, and the number of additional factors possibly leading to Captain Scott party disaster have

been presented. In section 11.1 of the current Chapter, I presented and discussed in detail thirteen causes of disaster referred to us by Captain Scott, as well as by a number of authors. The presented analysis did not confirm the individual notions that the listed causes lead in a meaningful way to the Captain Scott disaster. Since the Captain Scott party ultimately met its death on the Barrier in late March 1912, the investigative reader naturally may wonder what was the actual cause of their downfall. The same reader may also ask about additional causes of the disaster other than the ones listed in the *Message to the Public* by Captain Scott.

My actual examinations of additional causes of the disaster have been presented in Chapters 7, 8, and 9. Here, for the sake of the completeness of the current chapter, I will briefly recapitulate the main results and conclusions of these chapters.

11.3.1. No Food Shortages

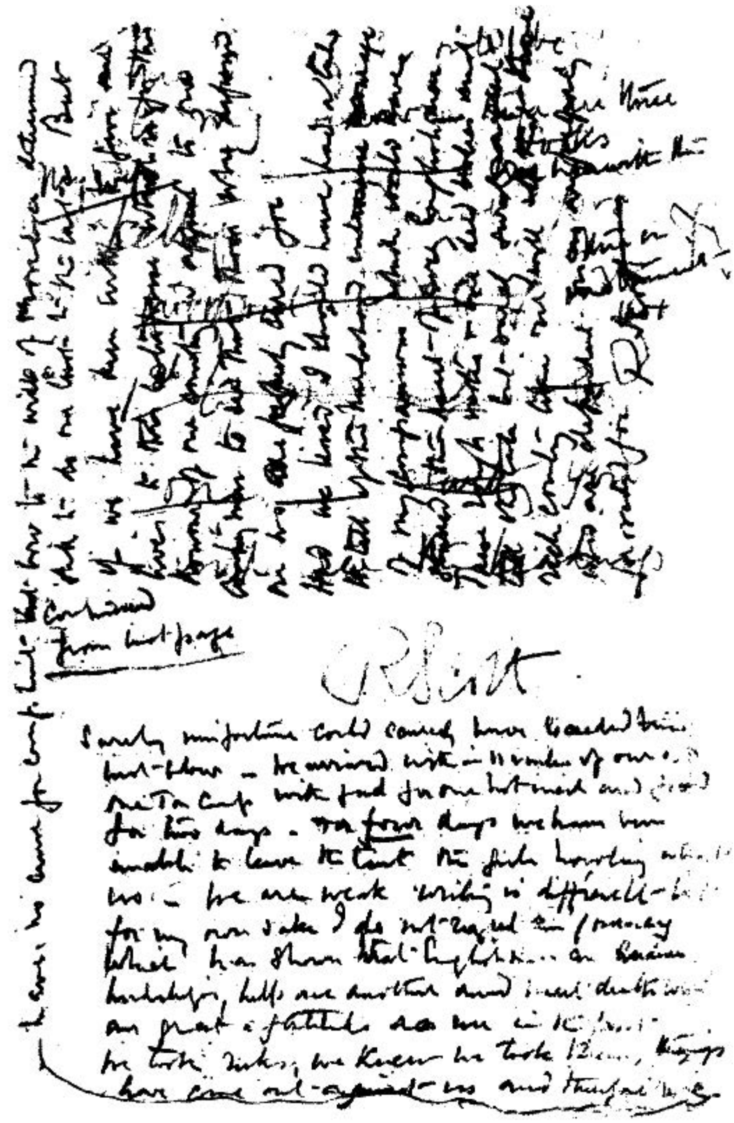
The entire journey to and back from the South Pole was chiefly about human endurance and logistics in its various aspects. The case of logistics must be understood as a general optimization problem of finding the *best* solution from *all feasible* solutions.

Did Captain Scott face real food shortages during his *South Pole Journey*? To answer this question, a number of issues must be addressed. The first one is that due to the limits of the hauling power of Captain Scott's men, their rations were, according to their knowledge, the minimum sustainable food allowances. In practice, it meant that the party was constantly in want of food. They were simply underfed, not to mention the fact that the food was monotonous and without variety.

The second issue is that contrary to Captain Scott's comments about actual food shortages, starting in February 1912 during the descent of the Beardmore Glacier, the party as I showed in section 9.2 was sledging on full rations according to the 144-days schedule. In subsection 11.1.9, I also discussed the influence of the Fifth Man on Captain Scott's food allowances during the final South Pole assault and Antarctic Plateau return stage. It was shown there that Captain Scott was perfectly able to recalculate his and the Second Return Party's food/fuel allowances. Therefore, both parties were sledging on full allowances due to the contingency plan implemented by increasing sledging velocity.

The third issue is the fact that the Captain Scott party after reaching the Shambles Camp, where ready to cook pony cutlets were deposited in December 1911, did not load nearly as many cutlets as they could and should have. They only prepared a relatively few hoosh meals compared to what they could have had taken. At this stage, Captain Scott sledged lightly, carrying only enough food/fuel rations to get them to the next depôt. It meant that the Captain Scott party could have easily packed a good number of pounds of pony meat and enjoyed its nutrition and taste.

The fourth issue is the most discrediting and destructive to Captain Scott's account. Due to the deaths of P. O. Evans on Feb. 17th and Captain Oates on Mar. 17th, food/fuel rations unused by them were available to the remaining party. Due to that, the last Captain Scott party (himself, Dr Wilson and Lt Bowers) had *full* food/fuel rations until at least until Mar. 27th, 1912.


Continued from last page

R Scott

Surely misfortune could scarcely have exceeded this
blow — we arrived within 11 miles of our old
One Ton Camp with fuel for one last meal and food
for two days — For four days we have been
unable to leave the tent the gale howling about
us — we are weak writing is difficult — but
for my own sake I do not regret this journey
which has shown that Englishmen can endure
hardships, help one another and meet death with
as great a fortitude as ever in the past —
we took risks, we knew we took them, things
have come out against us and therefore we

Figure 11.27. Captain Scott's last page of his *Message to the Public*.

The fifth issue is that towards the end of March 1912, the Captain Scott party was indeed short of food/fuel and was starving. Therefore, Captain Amundsen's assessment that[201]

> Scott and his four companions made a gallant effort to return to their base camp, but perished of starvation and exposure before they could reach it.

is only provisionally true for the final act of Captain Scott, Dr Wilson, and Lt Bowers' deaths.

However, until then they were capable of sledging and did not suffer from an alleged shortage of food.

11.3.2. No Fuel Shortages

Much of what was addressed in the preceding subsection (11.3.1) applies also to fuel and its shortages, as these issues were directly interconnected. This connection, however, did not result from the obvious relation that to prepare food, the cook of the day used the allowed daily amount of fuel. This connection resulted from the fact that in Captain Scott's journal, the first comments which appeared were about food shortages, and then as soon as these temporarily faded away, a new misfortune was recorded; shortage of fuel.

The investigative reader may recall here my detailed analysis of fuel consumption and its reported leakage as presented in section 9.2. From the diaries, it was possible to figure out that if leakage of fuel collected from the depôts occurred in February and March 1912, it did not exceed about 10% of volume, which is roughly about one day's fuel consumption (planned usage). However, the planned usage was defined according to the 144-days schedule which, as I discussed in section 9.2, was not exactly followed and the Captain Scott party approached the depôts more frequently than assumed.

On Feb. 24th, the party approached the Lower Barrier Depôt and Captain Scott added in his journal this curious account

> Saw depôt and reached it middle forenoon. Found store in order except shortage oil[26] – shall have to be *very* [*sic*] saving with fuel – otherwise have ten [*sic*] full days' provision from to-night and shall have less than 70 miles to go.

How, the investigative reader may wonder, did Captain Scott have ten (10) days provisions after visiting the Lower Barrier Depôt? According to the original plans, the returning party of four men should find seven days provisions at this depôt. The same amount of provisions should have been at the Lower Barrier Depôt after the re-arrangement of provisions, due to Lt Bowers going to the South Pole. However, since P. O. Evans was gone for exactly one week, his unconsumed rations were about ¼ of 1 unit. Due to the Fifth Man re-arrangement, the Lower Barrier Depôt contained 1¼. Therefore, the ration of food/fuel available to Captain Scott's four man party on Feb. 24th at Lower Barrier Depôt was $1\frac{1}{4} + \frac{1}{4} = 1\frac{1}{2}$ units. Since 1 unit was sufficient for 7 days of sledging, 1½ unit was sufficient for $1\frac{1}{2} \times 7 = 10\frac{1}{2}$ days! It almost exactly matches the figure that Captain Scott told us in his journal, since his figure was for that night, but the depôt had been reached that morning.

It looks like Captain Scott unconsciously slipped up, and disclosed the actual food and fuel available to his party during the Barrier leg. The analysis above wraps up my conclusions presented in subsection 11.1.10, and in particular Fig. 11.16.

The conclusion is palpable. Despite ~10% volume of fuel leakage, the party due to the deaths of P. O. Evans, and later Captain Oates, would have been in possession of full fuel allowances at least until Mar. 27th, 1912.

11.3.3. No Extreme Cold Snap

After the impact of the unfounded food/fuel shortages effectively faded away from the pages of Captain Scott's journal, the next misfortune, the *Extreme Cold Snap*, struck his returning party as Captain Scott described in his *Message to the Public*

> … all the facts above enumerated were as nothing to the surprise which awaited us on the Barrier.
> … no one in the world would have expected the temperatures and surfaces which we encountered at this time of the year. On the summit in lat. 85° 86° we had –20°, –30°. On the Barrier in lat. 82°, 10,000 feet lower, we had –30° in the day, –47° at night pretty regularly.

Reading his account above in an analytical way, one inevitably finds a number of serious scientifically questionable problems, as well as factual weather data dragging. I discussed all of the pertinent issues in Chapters 3 through 5, with respective analysis of Captain Scott's temperature data presented in Chapter 7.

Here, before summing up the neural network analysis of Captain Scott's temperature data, let me add a few additional comments.

The first and indeed intriguing point in Captain Scott's account is his word "surprise". It means that an *unexpected* or *unusual* event occurred. Without telling us how expected or normal an event is measured (estimated), Captain Scott explains that "no one in the world have expected" such an event. That was a far-reaching and unfounded conjecture and amounted to equating weather with climate. I explained this fallacy in subsection 4.2.1. Essentially, Captain Scott did not have climate data at a given location and time of year to produce a sensible (scientific) judgment about temperatures. The same thing led Dr Simpson, although a trained meteorologist, to confuse weather and climate. On several occasions, for different reasons I read the transcript of Dr Simpson's lecture[202], and every time I had the feeling that he must have known and understood the difference between minute events (weather) and summary events (climate). Especially towards the end of the lecture, I built up the expectation that in the next line Dr Simpson would say that the extreme cold snap reported by Captain Scott did not happen. Of course, nothing like that occurred, and it could not, since it would blame (unjustly) Dr Simpson for not predicting such severe temperatures. It would also question Captain Scott's 144-days sledging timetable as being too long. Consequently, it would question Captain Scott's man-hauling as too slow.

The second issue with Captain Scott's assumed account of temperatures is that he grossly exaggerated temperatures recorded at the summit (Antarctic Plateau) to be somewhere between "–20°, –30°" °F. On Fig. 11.28, I presented all temperatures recorded by the Captain Scott party at lat. 85°– 86°S. It is difficult to confirm from Fig. 10.28 that Captain Scott was accurate when he suggested temperatures between "–20°, –30°" °F.

Right after making the aforementioned temperature hyperbole, Captain Scott suggests that there is a relationship between

$$\{85°/86°\text{S, height } h_1\text{, temperature } T_1\text{, date}\}$$

and

$$\{82°\text{S, height } h_1 - 10{,}000\text{ feet, temperature } T_2\text{, date} + 2\text{ weeks}\}$$

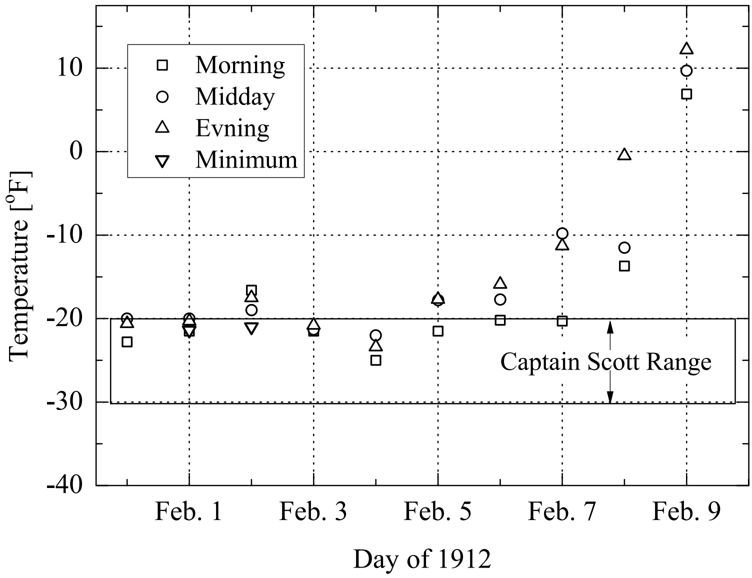


Figure 11.28. Temperatures recorded by the Captain Scott party during the Antarctic Plateau stage from Jan. 31st (location 86°45′S) until Feb. 9th, 1912 (location 84°50′S). Captain Scott's range of temperatures –20°, –30°F at the location of 85° 86°S is also shown for reference. Temperature data was taken from Dr Simpson's Vol. III[1] and from Captain Scott's journal respectively.

[1] George C. Simpson, *Meteorology*, Vol. III, Tables, Harrison and Sons, Ltd., London, 1923, *cf.* Table 72, p. 636–637.

Indeed, Captain Scott suggests that temperature T_1 was much lower than temperature T_2, and thus "recorded" temperatures of "–30° in the day, –47° at night pretty regularly" were because of a "sudden advent of severe weather, which does not seem to have any satisfactory cause".

However, Captain Scott is incorrect, and he confuses a number of issues. On June 10th, 1911, Captain Scott described Dr Simpson's explanation of blizzard phenomenon. He used a highly technical term at that time, "adiabatic gradient," to account for what one calls adiabatic lapse rate, which is "the rate of decrease of temperature with height of a parcel of dry air lifted by a reversible adiabatic process through an atmosphere."[203] Because an adiabatic process is reversible according to the first law of thermodynamics it means, contrary to Dr Jones' incorrect suggestion,[204] that a parcel of dry air will cool down when lifted from the Earth's surface, or it will warm when dropped down from an arbitrary height. A dry lapse rate of 5.5°F/1,000 ft (10°C/km).

Thus, by the instantaneous lowering of the height by about 10,000 ft, one must expect a 5.5°F/1,000 ft × 10 = 55°F increase of air temperature. Consequently, Captain Scott suggests that expected temperatures should be between +25°F and +35°F, instead of –30°F or –47°F at night, should be recorded at the lower Barrier in the month of February. Comparing the temperatures expected by Captain Scott in his *Message* obtained from the above calculation (+25°F and +35°F) with the respective analysis presented in section 3.2, one must again conclude that Captain Scott's

suggested temperatures were derived out of thin air, with a faulty method used as a smokescreen.

Similar calculations were presented in subsection 7.4.1. However, there I used the old historical 1918 year value of lapse rate. Regardless of the actual lapse rate, Captain Scott's conjecture about temperature similarities is incorrect, since he was comparing different geographical locations and different times of the year, as described in detail in subsection 7.4.1. Indeed, it was an empty argument by Captain Scott.

However, a real surprise awaited Captain Scott almost 100 years after his journey to and back from the South Pole. The surprise came from the development of scientific methods of weather data analysis, and its use in analysis of Captain Scott's temperature data and modern data from automated weather stations on the Barrier.

Captain Scott's persistence in collecting meteorological data finally paid off. In a most peculiar way, science and its methods enabled me to find the real temperatures in late February and March 1912. These results were presented in Chapter 7.

To finish this subsection, it is also pertinent to add that Captain Scott in his usual manner grossly exaggerated by saying in his final *Message* that "On the summit in lat. 85° 86° we had –20°, –30° [F]". On Fig. 11.28, I depicted respective temperature data from Jan. 31st (location 86°45′S) until Feb. 9th, 1912 (location 84°50′S). It is palpable from this figure that Captain Scott was exaggerating the actual temperature record.

One may address an interesting question as to who started forging the temperature data in late February 1912. The data available from Dr Simpson's table were taken directly from Lt Bowers' meteorological log. Thus, it appears that it was Lt Bowers who wrote these figures. I think it is virtually impossible that he did it without the knowledge and permission of Captain Scott. But it appears that it was Dr Wilson who was first to report a fabricated temperature a day before Lt Bowers did so. On Feb. 26th, Dr Wilson reports in his diary[205]

> Good day's going on ski with little breeze from S.S.E. Fat pony hoosh. Temp. down to –37 in the night.

and on the next day, Feb. 27th

> Overcast all forenoon and cleared to splendid clear afternoon. Good march on 12.2m ski. Some fair breeze. Turned in at –37.

Confronting Dr Wilson's temperature account with Lt Bowers' account: Feb. 26th {–21.7, –17.6, –22.0 and –24 (minimum temperature)}°F and Feb. 27th {–33.6, –15.8, –32.5 and –36.0 (minimum temperature)}°F, one readily notices that it was Dr Wilson who started forging the temperature record by writing that on Feb. 26th went down to –37°F, instead of about say –24°F. At that time, the party had two thermometers: one used by Lt Bowers to measure daily temperatures and when placed in shadow under the sledge the nightly minimum temperature, and one used by Captain Scott. Dr Wilson's –37°F could not have come from a malfunctioning thermometer from Captain Scott or Lt Bowers, so it was just fabricated. Consulting Captain Scott's journal, one finds temperatures recorded: –17°F and –21°F. Since it would be utterly contrived to assume that their thermometers later malfunctioned in synchronization, that neither Captain Scott nor Lt Bowers would not complain about malfunctions, or that they would not correct said malfunctions, one inevitably concludes that Captain Scott's and Lt Bowers' thermometers were in working order on Feb. 26th, and stayed

that way for the remainder of the journey. Thus, one ought to conclude that it was Dr Wilson who started tampering with the temperature record in late February 1912.

11.3.4. No Never Ending Gale

According to Captain Scott's account, the *Never Ending Gale* was a fourth extreme (black swan) event, preceded by unfounded food shortages (see section 9.4 and subsection 11.1.10), unfounded fuel shortages (see section 9.3 and subsection 11.1.9), and the unfounded *Extreme Cold Snap* Feb. 27th through Mar. 19th, 1912 (see sections 7.5 and 7.6).

In Chapter 8, I presented a detailed analysis of Mar. 21st through Mar. 29th, 1912 – *Never Ending Gale*, which was reported by Captain Scott. Towards the end of March 1912, Captain Scott, this time without the support of Lt Bowers or Dr Wilson spanning the duration of the event, reported in his journal a meteorological event which was extraordinary as far as its length and strength was concerned. This event was the *gale*, which lasted nine or ten days. Captain Scott's entry tells us that "Thursday, March 29. – Since the 21st we have had a continuous gale from W.S.W. and S.W." and continues that "Every day we have been ready to start for our depôt *11 miles* away, but outside the door of the tent it remains a scene of whirling drift."[206]

In Captain Scott's account, to many readers of his story, the *Never Ending Gale* is an *exodus* of classical Greek tragedy. It appeals to well-defined Aristotelian unities of drama: time, place and action. The event (occurrence) of the *Never Ending Gale* for a casual reader appeals to simple emotions and nullifies the reality. These emotions were simple. Every day, at least until Mar. 29th, Captain Scott and his party were ready to start for a full food and fuel depôt, just an insignificant 11 (in reality ~22) miles from their cold tent. Indeed, to perish so close to salvation is truly tragic and heartbreaking. All devilish forces were against Captain Scott.

But these forces did not originate in Antarctica. There was no *Extreme Cold Snap* (see Chapter 7), and there was no *Never Ending Gale* (see Chapter 8). Captain Scott went even further with his meteorological data fabrications by making up (see section 7.1) a *Super Extreme Cold Snap*. Combining these two black swan meteorological events, one is left with a meteorological disturbance of unprecedented and *unfounded* proportions:

Super Extreme Cold Snap

$$\left\{\frac{\mathit{Temperature}\,[°\mathrm{F}]}{\mathit{Feb}.27-\mathit{Mar}.19,1912}\right\}+\left\{\frac{\mathbf{-70}}{\mathit{Mar}.18},\frac{\mathbf{-40}}{\mathit{Mar}.19},\frac{\mathbf{-40}}{\mathit{Mar}.20}\ \text{through}\ \frac{\mathbf{-40}}{\mathit{Mar}.27}\right\}\frac{[°\mathrm{F}]}{1912}$$

$$+$$

Never Ending Gale

$$\left\{\frac{62-74}{\text{Mar. }21}\ \text{through}\ \frac{62-74}{\text{Mar. }29}\right\}\frac{[\text{km/h}]}{1912}$$

11.3.5. Captain Scott's Meteorological Data Fabrications

A number of publications appeared (printed and virtual), accompanied by a few exhibitions, about Captain Scott's centennial of his attainment of the South Pole. Yet again, a significant shift in viewing (and describing) was present, from the past Captain Scott as an explorer, to the new and current Captain Scott the scientist, for whom reaching the Pole was a secondary, if not an almost meaningless, goal compared to research projects and interests in various disciplines.

In section 4.4, titled *Biased Perception of Captain Scott as a Scientist*, I briefly described various related counterfactual and fallacious notions. Similarly in section 9.3, titled *Captain Scott's Food Supply and Glossopteris indica*, I also described the erroneous notion that specimens of *Glossopteris indica* collected by Captain Scott during his return from the Pole contributed to the formulation and development of continental drift theory.

In all instances when various people made conjectures about Captain Scott as a scientist, their accounts were vague, general, and lacking references and/or particularities. As a quick recent example, Colin Martin in a brief note entitled *Scientists to the End* commented that[207]

> He [Wilson – KS] didn't, of course, foresee that his own fate, and that of Scott and other colleagues, would long eclipse an enduring scientific legacy that led to the publication of 81 papers.

The degree of ambiguity of Martin's statement that it was Captain Scott's "scientific legacy that led to the publication of 81 papers" is about infinite. What is a scientific legacy? How did this legacy lead to the scientific publications? Why did Martin not name these papers so the reader could continue research on their own? Was there no space for listing these 81 papers in the prestigious journal Nature? Not exactly. The journal provides the possibility for authors to attach electronic supplementary materials to printed articles.[208] I even e-mailed Colin Martin using the email address taken from his article, to ask him for this list. No response was received.

Nowadays, without going to university libraries, one using the Google Scholar scientific search engine can find, for example, a number of citations of Captain Scott's *Last Expedition*. I obtained a result of 124 citations (2013). Does it mean that Captain Scott's journal was used (cited) in 124 scientific publications? Of course not. After going through the search results at scholar.google.com, I did not find one single scientific work which was based on Captain Scott's own research in Antarctica.

Even if my research into scholarly references to Captain Scott's scientific work was not sufficient due to time spent on it or incorrect search terms, it does not matter. Even if Captain Scott's contribution was greater than the one falsely overestimated by Colin Martin, one must conclude that due to the evidence of Captain Scott's data dragging and data falsification, he cannot possibly be admitted to the scientific community. There is no bigger crime in the scientific community than scientific misconduct, expressed by falsification of scientific data to prove unobserved phenomenon.

In an exact science like physics, the occurrence of fraud is rare. It results from the fact that every new theoretical or experimental evidence (result) of *significant* importance for a given subject will be sooner or later repeated and reconfirmed in a few independent laboratories. This alone constitutes the *vital* element of the scientific

method. However, in soft sciences like meteorology, the gate for scientific misconduct is wide open. ‘Publish or perish’ is the theme for many students and professors.[209]

For Captain Scott, the theme was ‘Exaggerate and perish’. After all, Antarctica is a cold place, and no one will be surprised with record low temperatures and high winds and blizzards. Since the weather is a set of temporary temperatures, wind velocity, *etc.* data (variables), who with his right mind will be clever enough to question low temperatures and high winds?

11.3.6. Historians’ Weather Data Fabrications

In the previous chapters, I have carefully analyzed many post-expedition weather data fabrications. Within these data fabrications, one can distinguish direct changes of actual temperature figures, and fallacious reasoning in relation to the fabricated and actual Captain Scott weather data during his *South Pole Journey*.

For all historians of different degrees, the change of Captain Scott’s weather data by lowering temperature and increasing wind velocity seemed like a natural business. After all, Antarctica is a cold place.

Indeed, not long after the death of Captain Scott and his fellow explorers, Leonard Huxley and Cherry-Garrard, who were working on the first edition of Scott’s journal, decided to lower a bunch of temperatures recorded by Captain Scott during his journey to the South Pole (see section 2.2).

These changes were nothing compared with the falsifications of weather data produced by Dr Susan Solomon. For fellows like Dr Solomon, Sir Ranulph Fiennes, Dr Barczewski, and Dr Jones, dragging weather data seems to be an ordinary business. After all, everyday TV (as well as radio, newspaper, and internet) presenters give the best guesses of upcoming weather conditions, and the viewers understand that these guesses are only approximations, *fair* approximations. However, such comparison (motivation) is unfair to weather forecasters. They do not forge their data. Their models, previous data, computer power, and the complexity of weather, limit the exact predictions, as I described in Chapter 1. Forecasters use scientific methods in good faith, contrary to people who simply falsify weather data.

The investigative reader may readily recall that in Chapter 7, I presented predictions of daily minimum temperatures encountered by the Captain Scott party in late February and March 1912. To obtain this data, I used the scientific method of neural network simulations, with all its advantages and pitfalls. This method to retrieve daily minimum temperatures was a scientific method, meaning that the investigative reader or anyone else could repeat these simulations and obtain the results presented in Chapter 7. Since the accuracy of neural network predictions is clearly dependent upon the size of the temperature training set one is using, their results may further improve the predictive skills of the neural network.

11.4. Synopsis

This chapter contained three major subsections and was heavily derived from the previous chapters, with the purpose of understanding the *real* causes of Captain Scott’s

disaster. All of the causes of Captain Scott's disaster mentioned in his *Message to the Public*, as well as addressed by various authors in post-expedition scrutiny, either did not take place and/or their contribution, even in an additive way, did not constitute a summary event leading to the deaths of Captain Scott, Dr Wilson, and Lt Bowers.

Up to now in my book, the causes of disaster, physical phenomena related to them, and Captain Scott's actions, for better understanding must be divided into the following categories:

1. Meteorological events or weather data that *never occurred or existed*:
   - 1.1. Meteorological events reported by Captain Scott:
     - 1.1.1. *Extreme Cold Snap* – February 27th through March 19th, 1912 (Chapter 7),
     - 1.1.2. *Super-Extreme Cold Snap* – February 27th through March 27th, 1912 (Chapter 7),
     - 1.1.3. *Never Ending Gale* – March 21st through March 29th, 1912 (Chapter 8),
     - 1.1.4. Miscellaneous and numerous exaggerations as described at various occasions through this book.
   - 1.2. Temperature data attributed to Captain Scott by various authors:
     - 1.2.1. Leonard Huxley's and Cherry-Garrard's temperature lowering (section 2.2),
     - 1.2.2. Dr Solomon's multiple temperature data dragging and falsifications, fallacious meteorological analyses, and comments (Chapter 4),
     - 1.2.3. Sir Ranulph's temperature and wind velocity exaggerations (section 5.2),
     - 1.2.4. Huntford's, Dr Barczewski's, and Dr Jones' miscellaneous meteorological misconduct (sections 5.1 and 5.3).
2. Weather events that *occurred*, but *did not* lead to disaster:
   - 2.1. Gale at 83°S (Four Days Blizzard) (subsection 11.1.6),
   - 2.2. Soft Snow at Beardmore Glacier (subsection 11.1.7).
3. Actions and/or events that taken, individually or in summary, *did not lead* to disaster:
   - 3.1. Reported by Captain Scott, or concurrent but without his knowledge:
     - 3.1.1. The Loss of Ponies in March 1911 (subsection 11.1.1),
     - 3.1.2. Fuel Leakage (subsection 11.1.9),
     - 3.1.3. Food Shortages (section 9.4, and especially subsection 11.1.10)
     - 3.1.4. Dr Simpson's and Dr Atkinson's mutiny[210] (Chapter 10).
   - 3.2. Proposed and considered in various post-expedition analysis (subsections 11.1.2 through 11.1.14):
     - 3.2.1. One Ton Depôt Location (79°28½′S, 170°E),
     - 3.2.2. Complexity of Transportation Methods,
     - 3.2.3. Misuse of the Dog Team,
     - 3.2.4. Navigation and Navigation Methods,
     - 3.2.5. Gale at 83°S,
     - 3.2.6. Soft Snow at Beardmore Glacier,
     - 3.2.7. The Fifth Man,

3.2.8. Fuel Leakage,
3.2.9. Food Shortages on the Barrier,
3.2.10. Collecting and Hauling Geological Specimens,
3.2.11. Vitamin Deficiency,
3.2.12. Neglecting the Sick,
3.2.13. Route Marking and Depôt Laying.

The above constitutes a summary of the major – *actual and alleged* – contributions/elements leading to Captain Scott's disaster.

In this rather lengthy chapter, I have examined the many important and feasible factors which allegedly directly or indirectly contributed to the Captain Scott disaster. Altogether, fourteen factors/issues have been analyzed. It was found that inevitably, all analyzed causes of the disaster had influenced the party's physical and physiological conditions. However, these influences, though observable, were not terminal and did not lead to the disaster. The additionally enumerated causes of disaster by Captain Scott in *The Message to the Public* were also dismissed on the grounds that:

- their individual or combined influence on the Captain Scott party did not lead to disaster,
- some of the events described by Captain Scott did not occur.

It was shown that at the beginning of February 1912, when the party approached and reached the Beardmore Glacier, the process of a continuous decrease of sustained sledging velocity appeared, and continued for roughly ⅓ of the entire round trip, yet went apparently unnoticed by the party. From the onset of this negative velocity gradient the party was, according to Captain Scott's journal, struck by a chain of events which did not occur: food/fuel shortages, *Extreme Cold Snap*, *Super Extreme Cold Snap*, and *Never Ending Gale*.

The causes of the disaster, individually or in combined form, as enumerated by Captain Scott and others, did not lead to the disaster. The events which occurred merely represented the expected and anticipated difficulties associated with the exploratory nature of the expedition.

Chapter 12

Etiology of Captain Robert F. Scott's Death

> *Because man dear* we can do without you *please know for sure we can. God knows I love you more than I thought could be possible, but I want you to realise that it won't [crossed out] wouldn't be your physical life [sic] that would profit me and Doodles [their son Peter] most. If there's anything you think worth doing at the cost of your life – Do it [sic]. We shall only be glad. Do you understand me? How awful if you don't.*
>
> Kathleen Scott's letter to Captain Scott[1]

> *Cui bono?*[2]

> *It was probably the beginning of the end.*
>
> Captain Evans[3]

> *I'm not young enough to know everything.*
>
> James M. Barrie[4]

Etiology according to the Merriam-Webster and Encyclopædia Britannica is "a branch of knowledge concerned with causes; *specifically*: a branch of medical science concerned with the causes and origins of diseases". In this chapter, however, I am not concerned with medical science except for psychology. I will in this chapter try to answer the perplexing etiological question: what was the cause(s) of Captain Scott's death? I will describe the reasons for the deaths of Captain Robert F. Scott, Dr Edward A. Wilson, Captain Lawrence E. G. Oates and Lt Henry R. Bowers. I will not evaluate on Petty Officer Edgar Evans' case, which in my opinion was caused by complex factors leading to health deterioration and consequential death.[5]

I belief that the very moments of death for Captain Scott's final party was from natural causes, but I also believe, due to my research presented in preceding chapters of this book, that the events leading to their deaths were premeditated and precisely executed. I am convinced that Captain Scott's party committed suicide in the manner characterized by Émile Durkheim as *altruistic suicide*.[6]

I spent a lot of time and consequently wrote several hundred pages on or about Captain Scott's *Terra Nova Expedition*. It was, as one could say, a research project formulated and developed without initial thesis or presumption. It was an entirely open research project to digitize Captain Scott's expedition.

Back in early 2008 I could not possibly know what my digitization and subsequent analysis of the *Terra Nova Expedition* would show. I could not know the results

of neural network simulations; summary of food/fuel sledging rations or calculations of sustained sledging velocity would prove. Step after step, or better to say calculation after calculation and figure drawing, quite a coherent picture was emerging. Captain Scott's *Terra Nova Expedition* appeared to be very much different than it was portrayed by Captain Scott himself, expedition members and finally various authors.

These accounts mentioned at various occasions thought this book were rather occasional contributions – simplistic descriptions. At a given time and location, Captain Scott's story was not a linguistic exercise. It was a *logistic undertaking* with many free (independent) variables. It was also according to Captain Scott in a statement given to the Royal Geographical Society in 1910[7]

> … the effort to reach a spot on the surface of the globe which has hitherto been untraded by human feet, unseen by human eyes, is in itself laudable; and when the spot has been associated for so long a time the imaginative ambitions of the civilized world, and when it possesses such a unique geographical position as a pole of the Earth, there is something more than mere sentiment, something more than an appeal to our sporting instinct in its attainment; it appeals to our national pride and the maintenance of great traditions, and its quest becomes an outward visible sign that we are still a nation able and willing to undertake difficult enterprises, still capable of standing in the van of the army of progress.
>
> But though this attainment of a pole of the earth be in itself a high enterprise worthy of national attention, it must be obvious that there are various ways in which such a project can be undertaken. It is possible to conceive the record of a journey to the pole which would contain only an account of the number of paces taken by the party, the food eaten, or the clothes worn. The interest of such a record would be entirely marred by our disappointment that so rare an opportunity to add to human knowledge should have been missed.
>
> It becomes, therefore, a plain duty for the explorer to bring back something more than a bare account of his movements; he must bring us every possible observation of the conditions under which his journey has been made. He must take advantage of his unique position and opportunities to study natural phenomena, and to add to the edifice of knowledge those stones which can be quarried only in the regions he visits. Such a result cannot be achieved by a single individual or by a number of individuals trained on similar lines. The occasion calls for special knowledge and specila training in many branches. I have entered into these preliminary arrangements in order to show the objects I have had in view in organizing the expedition.
>
> I have arranged for a scientific staff larger than that which has been carried by any previous expedition, and for a very extensive outfit of scientific instruments and impedimentia. Doubtless there are those who will criticize this provision in view of its published object – that of reaching the South Pole. But I believe that the more intelligent section of the community will heartily approve of the endeavour to achieve the greatest possible scientific harvest which the circumstances permit.

It is evident from the above Captain Scott account what the *Terra Nova Expedition* was about. The *Terra Nova Expedition*'s primary objective was being *the first* to reach the geographical South Pole. Like Mark Anthony in *Julius Caesar*, Captain Scott was letting the Brutus of his true intention go first before the Mark Anthony of science appealed to the RGS. Thus, Captain Scott's science swept his polar intention from the RGS's mind, and from the mind of every single historian to quote the speech since. What is just as telling is that Captain Scott's plan of stuffing in science where it would not compromise the primary goal was a virtual echo of Captain Amundsen's infamous statement that "On this little detour, science would have to take care of itself …" In fact, Captain Scott's definition of his expedition was indirectly recognized by Robert Peary in 1910 and 1912[8]

> In making his proposition to the National Geographic Society of Washington on Feb. 1, Commander Peary had two broad schemes of antarctic [*sic*] exploration in mind. *One was to be an attempt to reach the south pole* [*sic*] *as the chief objective, with such scientific work as might be undertaken incidental to such an expedition without jeopardizing its success*. [emphasis mine] The other embraced a series of south polar expeditions for scientific work pure and simple, without attempt to reach the pole, but rather a complete circumnavigation of the polar region for modern scientific research.
>
> …
>
> Antarctic exploration, he [Peary – KS] said, is divided in two classes: *First, efforts for the attainment of the south pole* [*sic*], *with such subsidiary scientific work as might be done without interfering with the main purpose of the expedition;* [emphasis mine] thereafter, circumnavigation of the antarctic [*sic*] regions with a specially fitted ship and a staff of scientific explorers.

Peary's analysis of Antarctic exploration is highly intelligent, as it notices and defines the last geographical objectives remaining to Antarctic exploration, includes prudent amounts of scientific work, and defines the priorities of these two exploration models. Captain Amundsen followed Peary's first model in his managing of the *Northwest Passage Expedition*, where the establishment of the wandering of the Magnetic North Pole was worked into the primary goal of sailing through the Northwest Passage. He followed Peary's second model in his managing of the *Maud Expedition*, which circumnavigated above the Arctic Circle while conducting scientific research.

Not only Captain Scott was stressing that the main goal of the *Terra Nova Expedition* was reaching the South Pole. On this matter, Captain Scott's views were also shared by the man described by Charles Wright as the "prop and advisor to Captain Scott"[9] Dr Wilson, who on Oct. 17th, 1911 noted in his diary[10]

> I don't see any other course open to me then to carry through the job I came here for, which was in the main this sledge journey for the Pole "*L'homme propose, mais le bon Dieu dispose*" [Man proposes, God disposes – KS] is an honest creed, and in this case *l'homme* hasn't decided to do anything from first to last that he wasn't convinced would be approved by his infinitely better half, and *le bon Dieu* [the good God – KS] will do the rest. Whatever of

> bad news there may be in the letters that are to come, believe me, if I can't act on them I shall be sorry indeed, but I shall not be unprepared for anything. Whatever happens, even if it's worse than anything one can bring oneself to imagine, there is no more to be said or done than this.

Does anyone, after reading the descriptions of expedition priorities expressed by Captain Scott and his prop/advisor Dr Wilson, have any doubts that for a long period of time, the main objective of the *Terra Nova Expedition* was conquering the South Pole?

Taking temperature measurements, even in Antarctica, is not particularly exciting. However, sledging to the Pole, Captain Scott's *own* Pole, was a different matter. All emotions were focused on the *bindu* on the Antarctic Plateau called the South Pole.

However, if anyone would argue that Captain Scott's above statement taken from his *Plans of the British Antarctic Expedition, 1910* is not representative, let me bring to the reader's attention an additional view from Captain Scott of his expedition's goals expressed in a 1909 letter to Leonard Darwin, the son of Charles Darwin and the president of the Royal Geographical Society (1908–1911). Note Captain Scott's statement of the main goal, and his directed emphasis on the science commending itself to the RGS[11]

> My dear Major Darwin, – At this juncture in the history of Polar Exploration I think it is absolutely necessary to continue those efforts which have given to this country the foremost place in Antarctic Research. I have undertaken the task of organizing an expedition and submit to you in brief the program which I propose to adopt.
> I believe that the main object, that of reaching the South Pole, will appeal to all our countrymen as the one rightly to be pursued at this moment, but the plan which I present provides also for the scientific exploration of a considerable extent of the Antarctic continent and will therefore I hope commend itself to the Royal Geographical Society.
> I should be glad to receive an expression of your approval and trust that I may have the benefit of your advice and assistance in preparing the Expedition.
> Believe me,
>
> Yours sincerely, R. Scott

And if even that was not enough, there is yet more evidence. A dramatic piece of evidence as to Captain Scott's primary goal can be found just as the *Terra Nova* was leaving Cardiff in June 1910. What he allegedly said was described by Anthony Johnson[12]

> The Lord Mayor's party remained aboard the *Terra Nova* as far as Breaksea Lightship before their final parting in late afternoon aboard the tug *Falcon* accompanied by Capt. and Mrs. Scott. Three years later, Daniel Radcliffe recalled Scott's prophetic last words as he departed the *Terra Nova*, 'I will reach the Pole or I will never come back again.'

Assuming it was not just wishful thinking by Radcliffe to create a prophetic moment, it is an incredibly telling statement. It may be telling on the surface, but what is even more telling than the words is the timing. Captain Scott was not before a public

crowd of arbitrary size that needed to be stirred with drama. He was not sailing away and thus in need of a dramatic final statement. In fact, he was either in the act of leaving the *Terra Nova* or already away from it on a tugboat with a few other people; either way, he was on his way back to Britain to spend several more weeks fundraising. Yet Captain Scott chose this moment to make a dramatic statement of his intentions. If this statement is true, it is the strongest piece of evidence that initially his primary goal was priority at the South Pole. Thankfully, my thesis does not rest on this piece alone.

The fact that Scott Keltie, secretary of the Royal Geographical Society, knew what Captain Scott's true objective was revealed by Dr Barczewski in a surprising moment of honesty about British efforts to *Deus ex Machina* Captain Scott's expedition into a scientific expedition[13]

> In reality, this was a postmortem reinvention of events that would never have occurred had Scott won the race. Privately, Keltie admitted that attempts to argue that the Pole had only been an ancillary goal were specious. 'It is no use in the papers saying the Pole was merely a secondary matter …' he wrote to Kathleen in April 1912. 'We know very well that he had set his mind upon it.'

Even the location Captain Scott chose for his base gave away his intentions. J. Gordon Hayes insightfully observed the unsuitability of Ross Island for scientific work at the time that Captain Scott chose it, but failed to draw from this that Captain Scott had an ulterior motive of achieving priority at the South Pole and quickly moved on to praising the expedition's scientific results, perhaps to protect his own image[14]

> It is an extremely obvious criticism of this expedition that it lacked originality. Seventy-five thousand pounds [*sic*] of public money, while the greater part of Antarctica was unknown, could have been put to better use than that of merely revisiting old scenes. No expedition, after Shackleton's, should have established its Main base upon Ross Island; for there was no branch of work left to be done in that district that was not needed much more urgently elsewhere. The attainment of the Pole, we are dubiously told, although Scott's personal effort, was secondary to the scientific work. The main object of all the other great Antarctic expeditions, including Scott's brilliant earlier voyage, had been geographical discovery. This important object should have been kept steadily to the front as long as so many thousands of miles of Antarctica remained unknown. The *Terra Nova Expedition*, judged by this, was badly planned. Its scientific work was too highly intensive for the present stage of Antarctic exploration; while, as Sir Clements Markham said of Peary, mere dashes to the Pole are almost useless. Had Scott lived to carry out the second season's work that he proposed, and had Campbell been able to explore King Edward VII Land, the geographical results of the expedition would, almost certainly, have been fairly good; though they could hardly, even then, have equalled the achievements of the *Discovery* Expedition. Pony-transports, however, would have come to grief very soon in the excessive snow-fall of King Edward VII Land.
>
> Antarctica, when Scott went out, was, as it is yet, by far the greatest geographical problem in the whole world; yet scarcely any effort was made by this expensive expedition to further its solution. Ross rightly said that the

> British were accustomed to *lead* [emphasis original] the way in exploration; but this noble tradition was forgotten by the aged and nerveless initiators of the *Terra Nova* Expedition. All that might have been accomplished by descending upon some unknown, or little-known, coast was sacrificed for a hundred miles of continental ice. [referring to the remaining unexplored distance to the South Pole – KS] The scientific work, in truth, was excellent; but much of it had been done once before, and some of it as much as twice before, in the same district. Thus the expedition was mainly a repetition of previous ones, on a somewhat larger scale, when another huge inroad into the unknown could have been made. One, at least, of these previous expeditions to McMurdo Sound had not been inferior to Scott's last enterprise in scientific or any other ability. Shackleton had men on his staff of at least equal scientific distinction to any whom Scott was able to command. When Dr Taylor's Party arrived at the Discovery Hut, after the first geological journey, Scott wrote: "The main part of their work seems to be rediscovery of many facts which were noted but perhaps passed over too lightly in the *Discovery*." Scott admitted the principle, without seeing its full implication. He might have added that Shackleton nearly completed whatever the *Discovery* began; so that no more needed to be done in that locality until the rest of Antarctica had at least been charted.

Did Captain Scott fulfill his hidden 1910 promise to the RGS that science would be compromised when the goal of priority at the South Pole demanded it? Did his scientists feel that when that opportunity came, he shortchanged science for the sake of the South Pole? The answer is yes in at least one case. Dr Taylor wrote about Captain Scott's decision 5 years later[15]

> On Queen's birthday [*sic*] Captain Scott informed me that he was afraid I should be able to do very little science on the southern trip. "You would only be able to go up the Beardmore and down again, so your time would practically be wasted." So that he decided that I should go west to Granite Harbour, at which I was very pleased, though it was rather rough on Debenham, who was to have had charge of a party in that region. Dr. Bill pointed out that Debenham and I were fully occupied with different aspects of geology, so that there was room for both of us, and Scott arranged that I was to take Gran and Forde as the other members of the party.

That Dr Taylor privately felt science was being shoved to elsewhere and shortchanged for the sake of Pole-seeking can be seen from the fact that he had Dr Wilson draw up an extensive list of geological observations to be made by Dr Wilson on the Beardmore Glacier.[16] Captain Scott could have accommodated Dr Taylor's wish for observing the Beardmore Glacier by quite simply putting him in the group for the polar journey, then sending him back with a returning party. He would have gotten his objective, and so would Dr Taylor. But Captain Scott would have none of it. He had mentally put up with taking part in prior scientific journeys for the sake of his *Deus ex Machina*. Now that his primary goal was just a journey and a chance forestalling of Captain Amundsen away, he could shove the scientific work away from himself and go for what he really desired.

Strangely, not a single historian has been willing to draw this simple conclusion from this convergence of evidence, and some of them feel the need to exaggerate the importance of science to Captain Scott. From the subtle, context-rich paragraphs of Captain Scott's 1910 speech to the RGS, Dr Max Jones draws the twisted conclusion that[17]

> From the outset, then, Scott raised the conquest of the South Pole as the expedition's primary aim. Yet crucially Scott went on to argue … Although an independent venture, Scott's last expedition bore the imprint of the template forged by the RGS after the death of Dr Livingstone, as Scott planned to reap a scientific harvest while engaged on a heroic quest in the service of the nation.

Like Captain Scott, Dr Jones uses the Brutus of the real goal before sweeping it away with the Mark Anthony of science. Even worse, Edward Larson in his book *An Empire of Ice* does not even bother to take note of Captain Scott's Brutus effort when he quotes from this same RGS speech, and carelessly declares that "All in all, Scott had sketched out a highly ambitious plan for science. Certainly the *Discovery* and *Nimrod* expeditions had not attempted anything so bold, and Amundsen did not even offer a pretense of science to mask his polar ambitions."[18] But this misrepresentation is just the beginning for him. He notes about the *Antarctic Manual*[19]

> Sedimentary strata offered the most potential, the *Manual* stressed, because they held clues to the climate and distribution of land and sea in earlier ages. "The most useful information on these questions may be afforded by remains of animals and plants found imbedded in the rocks," the *Manual* explained, particularly the discovery of *Glossopteris* plant fossils of the type common to Africa, Australia, India, and South America in the late Paleozoic era. Finding *Glossopteris* fossils in Antarctic rocks from that era would support the theory [*sic*] that these four regions were once linked through Antarctica. If these fossils were also found in older rocks, the *Manual* noted, it would show that prehistoric global cooling had allowed these presumably cold-climate plants to move north from the Antarctic.

In his two citations in the endnote he provides for his paragraph, Larson cites the *Antarctic Manual*, pages 202–203 and page 176. The second citation is not only incorrect due to the relevant content beginning on page 177, but it is also selective and false citation. To make the claim that finding *Glossopteris* in Antarctica was paramount to prove a *theory* of continental connection and to prove a northward spread of it, Larson deliberately cites page 176 and avoids citing the next 2 pages of the *Antarctic Manual*. The inconvenient passages in these pages show that said finding would be merely one new step in proving the established hypothesis – not theory as Larson erroneously represents it – of continental connection, and that evidence of northward spread of *Glossopteris* had already been shown[20]

> Evidence suggesting land communication in past times between the Antarctic area and the other Southern continents has accumulated greatly during the last thirty or forty years. Perhaps the most remarkable instance is that connected with the distribution of the southern Permo-carboniferous

> or *Glossopteris* flora. This flora has been long known in South Africa, India and Australia, and recently it has been discovered in South America and in Russia …
>
> Curiously enough, there is much to suggest that this *Glossopteris* flora came originally from the South to Africa, America, Australia and India, for it was preceded in three of those areas by an earlier flora of the Northern Palaeozoic type and the line of division between the two floras is marked by a bed containing boulders transported by ice, and affording evidence of a phase of low temperature. It is not an unreasonable inference that this *Glossopteris* flora, which is singularly poor in species, is the offspring of a cold climate vegetation, that it had its origin in the Antarctic continental area and was driven Northward towards the equator along tracts of land now beneath the ocean, during the prevalence of a period of cold similar to the glacial epoch of Pleistocene times, until it finally reached and crossed the equator and replaced the old Palaeozoic flora of our coal-measures. Should any traces of the Glossopteris flora be found in the Palaeozoic rocks of the Antarctic area, especially if there be reason for believing that these rocks are more ancient than the Glossopteris beds of Australia and South Africa, the hypothesis above suggested will be strongly supported …
>
> The *Glossopteris* flora is by no means the only indication of connection between the Southern continents through the Antarctic area … It is quite true that no single instance of those cited affords conclusive evidence of land-connection with the Antarctic region, but the cumulative evidence, especially in the case of Mammals and Batrachia, distinctly proves land-connection of some kind and appears to indicate a possibility that in upper Mesozoic and Tertiary times, as in upper Palaeozoic, communication by land existed between the continental masses of the Southern Hemisphere and the Antarctic continent.

The investigative reader may discover that Larson's book was published by Yale University Press, the same publisher who published Dr Solomon's book of falsehoods. Another troubling issue with Larson's honesty, or the honesty of Yale University Press, appears on the cover of the book itself. Below his name are the words "Winner of the Pulitzer Prize".[21] Larson has received a Pulitzer Prize for another history book,[22] but *An Empire of Ice* is not a Pulitzer Prize winner, and its cover should not misrepresent the author's previous Pulitzer Prize as being its own. In case anyone decides to argue that this is trivial quibbling since no one could reasonably make the mistake of believing that this book is a Pulitzer Prize winner, permit me to point out that the Scott Polar Research Institute's museum shop is misled into committing this very mistake. It titles the book's entry: "AN EMPIRE OF ICE – Winner of the Pulitzer Prize"[23]

On their return journey, Captain Amundsen and his team collected geological specimens at Mount Betty. These specimens were brought back by them, unlike Captain Scott, and were put to use to make a first step towards determining the geology of South Victoria Land.[24] In his action of coming back alive with his specimens, Captain Amundsen showed greater devotion to geology than Captain Scott. Edward Larson owes him an apology.

⋮

The first awakening in Captain Scott's thinking about reaching the South Pole to reconfirm "our national pride and the maintenance of great traditions" *as it appears* from his journal, came early on Feb. 22nd, 1911 when he received news from Lt Campbell about Captain Amundsen's landing at the Bay of Whales[25]

> But every incident of the day pales before the startling contents of the mail bag which Atkinson gave me a letter from Campbell setting out his doings and the finding of *Amundsen* established in the Bay of Whales.
>
> One thing only fixes itself definitely in my mind. The proper, as well as the wiser, course for us is to proceed exactly as though this had not happened. To go forward and do our best for the honour of the country without fear or panic.
>
> There is no doubt that Amundsen's plan is a very serious menace to ours. He has a shorter distance to the Pole by 60 miles – I never thought he could have got so many dogs safely to the ice. His plan for running them seems excellent. But above and beyond all he can start his journey early in the season – an impossible condition with ponies.

Captain Scott's account of Captain Amundsen's presence in Antarctica is *intriguing*. He is correctly assessing the potential of dogs as a draught animal despite his perspective of the previous failure with dogs during the *Discovery Expedition*. Despite his bad experiences, he is not raising doubts about Captain Amundsen's plans. Was this the shadow of Captain Amundsen's success with dogs in the Northwest Passage that Captain Scott's vaunted observational skills had caught too late to integrate into his initial plans? Now Captain Scott must have felt Captain Amundsen "very serious[ly] menace[ing]" his hope for priority at the South Pole.

Captain Scott's above-quoted response to Captain Amundsen has become a favorite target for selective quotation by his modern amateur hagiographers to prove that he was not interested in priority at the South Pole. They applaud his decision "to proceed exactly as though this had not happened. To go forward and do our best for the honour of the country without fear or panic," yet leave out where Captain Scott literally in the next sentence continued and explained why "There is no doubt that Amundsen's plan is a very serious menace to ours." Captain Scott's abrupt change of tone strongly suggests fear and panic, contrary to his bold declaration. Judging by the fact that the next direct mention of Captain Amundsen's chances of success was only in October 1911 in a letter to his wife which was incorporated into the published version of his diaries, Captain Scott was repressing Captain Amundsen's presence as much as he could

> *October 1911* – I don't know what to think of Amundsen's chances. If he gets to the Pole, it must be before we do, as he is bound to travel fast with dogs and pretty certain to start early. On this account I decided at a very early date to act exactly as I should have done had he not existed. Any attempt to race must have wrecked my plan, besides which it doesn't appear the sort of thing one is out for.

Once again Captain Scott contradicted himself. He had gone from "There is no doubt that Amundsen's plan is a very serious menace to ours" to "I don't know what to think of Amundsen's chances." The only explanation for these confused responses is that Captain Scott was faced with a Norwegian nightmare looming in the east, and

trying to rationalize it away with the hope that Captain Amundsen would be forced back and/or run into catastrophe. This rationalization would continue until the harbinger of reality, the black flag on Jan. 16th, 1912. However, it appeared to Captain Scott that some contingency plan should be envisioned to counter any fallout from his original laudation for the South Pole and its attainment (see above RGS 1910 citation).

What contingency options could Captain Scott have in late February 1911? It appears that he could:

1. Change at this time still vaguely envisioned sledging plan and figure contingency plan by using sledging dogs,
2. Proceed as originally planned and shift the expedition paradigm (main objective) from the South Pole to science (scientific research).

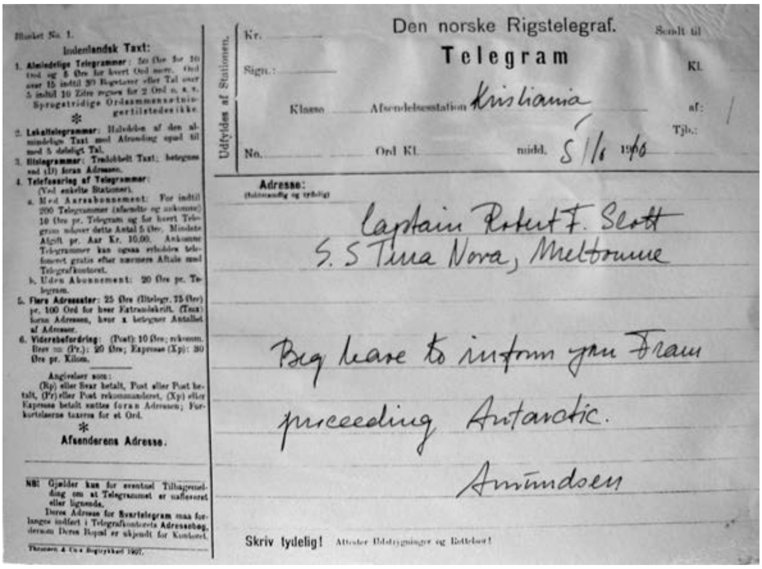
Since a part of the sledging plan was already implemented and defined by laying One Ton Depôt (see subsection 11.1.2), the question of the possibility of changing the rest of the plan by increasing the role of the dogs arose. Besides Captain Scott's team's uncertain ability to drive dogs, besides the number of dogs, the question was of a logistical nature and a matter of calculations which obviously would take some time, but not a particularly long time. It only took Captain Scott less than a day after becoming aware of Captain Amundsen's presence in Antarctica to declare his façade decision "to proceed exactly as though this had not happened". Ultimately, his actions point to the conclusion that he did not give much thought to the first option (point 1 above). Thus, the second option was chosen to proceed as planned but with increasing emphasis that the main goal of the expedition was science and research. On the surface, reaching the South Pole become a mere side issue to science.

It was a solid contingency plan, which in different shades propagated into public understanding to the present day. After learning about Captain Amundsen and his plans, Captain Scott become mysterious about his dog usage. From one side, he needed dogs to support his journey to the South Pole (Meares and Dmitrii). On the other hand, he did not want the dogs to be seriously involved and ordered not to risk them and save for suspiciously *unspecified* upcoming sledging journeys.

The investigative reader must read the above comments when Captain Scott learned about Captain Amundsen's presence in Antarctica with increasing doubts about my historical accuracy. However, it was not me but Captain Scott who wanted to obfuscate the readers of his journal, as cited above, that he rather learned about Captain Amundsen's intentions in February 1911, and not in November 1910. Not only Captain Scott had such a wish. Sir Clements Markham, *éminence grise* of Polar exploration, ex-President of the Royal Geographical Society, also was trying to convey to the public that[26]

> Captain Amundsen's plan was different. He conceived the idea of making a dash for the South Pole without Captain Scott's knowledge, and his presence was only found out by the *Terra Nova* arriving where he landed. Captain Scott knew nothing about it until his return from his great journey late in the Autumn. His plans were then all matured [*sic*], and Captain Amundsen's scheme, if he had known what it was, would not have affected them in the slightest degree. Captain Scott would, I believe, wish success to my friend Amundsen, as I did, but there was no race.

Indeed, Lt Campbell spotted *Fram* at the Bay of Whales in February 1911.[27] Upon receiving this news from Lt Campbell on Feb. 22nd, 1911 Captain Scott described his ambiguous and telling reaction. He did not disclose to the readers of his journal that he knew well before departing to Antarctica that Captain Amundsen was heading in the same bearing. Although his information consisted of a laconic and enigmatic cablegram (see Fig. 12.1), Captain Scott could figure enough to seriously


Den norske Rigstelegraf.

Telegram

Afsendelsesstation Kristiania

midd. 5/10 1910

Adresse:

Captain Robert F. Scott
S. S Terra Nova, Melbourne

Beg leave to inform you Fram
proceeding Antarctic.
Amundsen

Indenlandsk Taxt:

Afsenderens Adresse.

Skriv tydelig!

Figure 12.1. Captain Amundsen's cablegram to Captain Scott on display at the *Fram* Museum in Oslo. It reads "Beg leave to inform you Fram proceeding Antarctic. Amundsen" The day is unclear except that it is a single digit (3?) followed by 10 (October), 1910. There is a significant difference between this and other's reproductions of Captain Amundsen's cablegram.[1]

[1] The contents of Captain Amundsen's cablegram were wrongly reproduced by the following: Cherry-Garrard (*The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. I *cf.* p. 41), David Crane (*Scott of the Antarctic, A Life of Courage and Tragedy*, Alfred A. Knopf, 2005, *cf.* p. 423), Diana Preston (*A First Rate Tragedy: Robert Falcon Scott and the Race to the South Pole,* Houghton Mifflin Company, Boston, 1998, *cf.* p. 127): *Madeira. Am going South. Amundsen*. Dr Solomon (*The Coldest March: Scott's Fatal Antarctic Expedition*, Yale University Press, 2001, *cf.* p. 64) informs that the cablegram was lost though she gives the correct wording. Since Huntford gives the correct wording, she must have taken it from his book. At this point, it is appropriate to acknowledge Captain Amundsen's own account (*My Life as an Explorer*, Doubleday, Page and Company, Garden City, 1927, *cf.* p. 65–66).

"I wish also at this point frankly to meet some criticisms of my action in competing with Captain Scott, which are based on popular misapprehension of some essential facts and which, I feel, has left me unfairly compromised in many minds. One story is to the effect that, from a sporting point of view, I took an unfair advantage of Captain Scott in that I gave him no notice, so the story goes, of my intention to make my expedition a race with his. The truth is quite otherwise.

Captain Scott had the fullest possible notice of my intentions, both before he left Australia and again after we had both established our base camps in the Antarctic. When I sailed from Madeira in the fall of 1910, I left with my secretary a sealed envelope containing a cablegram to Captain Scott in Australia, which he, in accordance with my instructions, sent a few days after we were safe at sea, and which disclosed fully my intention to compete with Captain Scott for the South Pole."

think about Captain Amundsen and his possible challenge. Obviously the meaning and purpose of Captain Amundsen sending the cablegram was to inform Captain Scott that his attempt to reach the South Pole will be challenged.

After receiving Captain Amundsen's cablegram in Melbourne, Australia, Captain Scott had an ample amount of time to consider the above mentioned logistical points 1 and 2. None of that happened and apparently he decided to proceed in the way envisioned before until reality came knocking in February 1911. Although Captain Amundsen's cablegram should have been known to everyone, Lt Campbell later finding Captain Amundsen at the Bay of Whales apparently came as a surprise and Captain Evans commented[28]

> We spent a very unhappy night, in spite of all attempts to be cheerful. Clearly, there was nothing for us but to abandon [*sic*] science [*sic*] and go for the Pole directly the season for sledging was advanced enough to make travelling possible after the winter. It now became a question of dogs versus ponies, for the main bulk of our stuff must of necessity be pony-drawn unless we could rely on the motor sledges – nobody believed we could.

One more time, in tacit agreement with Captain Scott and other explorers, Captain Evans is leading the investigative reader away from the main point. While preaching to science, he *superficially* with accordance to Captain Scott attributes the result of getting to the South Pole first as a "question dogs versus ponies". However, this is wrong for various reasons. Captain Evans entirely scraps (or detaches) human involvement in the race. Only dogs and ponies mattered? The investigative reader immediately understands that it was not the case.

I am saying all the above to point out that even the second in command Captain Evans, who might feel some bitter grief toward Captain Scott, follows the Owner's false and casual perception of events and possibilities. In no way is Captain Evans analytical and/or rational. Sledging to the Pole did not automatically mean to "abandon science" and engage explorers in dragging sledges.

Was not going to the Pole the main goal of the expedition? It was, at least initially. Captain Scott explained this in his *Plans of the British Antarctic Expedition* published in the Geographical Journal as partly cited above. Of course, not only the South Pole's attainment was planned, but all around research as well. However, the South Pole was the *bindu* of the expedition.

The question of whether scientific research or attainment of the South Pole was the main objective of the *Terra Nova Expedition* is an illegitimately complex question. It contains many presuppositions that have not been proven and/or accepted by all the people involved in the expedition or past and present observers. Captain Scott's expedition may be defined (described) as a scientific expedition, exploratory expedition, the South Pole expedition, Imperial expedition, Captain Scott's personal adventure expedition, Sir Clements Markham's expedition, deadliest expedition, *etc*. None of these, taken as the only description, could define the actual expedition as it was a complex undertaking with many singular objectives and goals.

12.1. Captain Scott's *Deus ex Machina*

Do I contradict myself?
Very well then I contradict myself,
(I am large, I contain multitudes.)

Walt Whitman in *Song of Myself*

12.1.1. Utilitarianism Crucible

In subsection 3.2.1 and Table 10.6 I casually mentioned that during the *Discovery Expedition* Captain Scott's experience with sledging dogs on his *Southern Journey* (Nov. 2nd, 1902 through Feb. 3rd, 1903), based on Sir Francis McClintock's ill and unverified advice of dog food rations (see Table 10.6), was a major event/blunder which changed the whole *Heroic Age of Antarctic Exploration* and in particular Captain Scott's sledging strategy and methods.

Indeed, at the time of the *Discovery Expedition* Commander Scott was a tyro to all aspects of polar exploration. He blandly followed orders and the instruction book called the *Antarctic Manual*.[29] None of the *Southern Journey* parties knew about or had tacit knowledge about dog sledging and dog behavior. Despite many empty-handed considerations of sledging dog usage, it turned out that[30]

> Only when it comes to the treatment of their dogs on the Southern Journey, perhaps, does Scott lapse from the standards of integrity that survive all the omissions of the book. It is clear from the original diaries that the animals were carried on the sledges to keep them alive as fodder, but although this is plain enough in the published version, there are moments when Scott fights shy of spelling it out, too ashamed, too guilty-and too conscious of his readership, one suspects-to face up to the full cost of his Southern Journey in terms of the cruelty and suffering it caused.

Captain Scott's widely available account of the *Discovery Expedition* was written during his post-expedition leave from the Navy and well before his real interest of launching the next the *Terra Nova Expedition*.[31] Therefore, Captain Scott's account of the *Discovery Expedition* must be understood as a post-expedition reflection.

It appears that during that time, Captain Scott in his thinking about sledge dog usage in Antarctic exploration gradually adopted *utilitarianism*, a theory in normative ethics, which was slowly taking root in British society. The roots of utilitarianism are convoluted with the Industrial Revolution (1760–1840) and continuous replacement of human and animal power by various new machines. The change of rural society into industrial society significantly reduced animal usage in everyday tasks. In pace with these changes, its theoretical descriptions were mainly produced in the works (books) of Jeremy Bentham (1748–1832) and John Stuart Mill (1806–1873) who noted

> Nothing is more natural to human beings, nor, up to a certain point in cultivation, more universal, than to estimate the pleasures and pains of others as deserving of regard exactly in proportion to their likeness to ourselves …

> Granted that any practice causes more pain to animals than it gives pleasure to man; is that practice moral or immoral? And if, exactly in proportion as human beings raise their heads out of the slough of selfishness, they do not with one voice answer "immoral", let the morality of the principle of utility be forever condemned.

or in a more compact form[32]

> *Utilitarianism* – a theory that the aim of action should be the largest possible balance of pleasure over pain or the greatest happiness of the greatest number.

In Chapter XI, meaninglessly titled *Typical Sledging Experiences*, Captain Scott attempted to review the *Discovery Expedition* sledging arrangements. In the following subsections titled *Use of Dogs for Sledging*, *A Discussion of their Merits*, *History of our Dog Team*, *Discomforts of Sledge-travelling*, Captain Scott, under the tacit notion of thorough re-assessment, repeated what was known to him before and during the expedition. It is surprising that despite having a wealth of books and reports on Arctic usage of sledging dogs, he entirely ignored it and blandly followed the *Antarctic Manual* and Sir Francis' paper originally published in 1875 that was re-printed in it.

It shows how un-scientific Captain Scott was in his approach to this *central* issue of his expedition. It would not take much effort to open a few books, including McClintock's volumes to find that the dogs used on the *Southern Journey* were doomed from the very start, because in calculations of food rations for dogs Captain Scott's party used an *erroneous* ½ ration instead of 1 ration (see Tab. 10.6). Consequently, the dogs were terribly underfed and soon after Captain Scott, Dr Wilson and Lt Shackleton departure from Hut Point (Nov. 2nd, 1902), the dogs already on Nov. 16th "seemed to lose all heart" and before long began to deteriorate.

Instead of addressing the real issue of proper dog rations, Captain Scott turned into a lamenting and dog compassion mode which he summarized as a newly born utilitarian advocate[33]

> I have endeavoured to give a just view of the use of dogs in polar enterprises. To say that they do not greatly increase the radius of action is absurd; to pretend that they can be worked to this end without pain, suffering, and death is equally futile. The question is whether the latter can be justified by the gain, and I think that logically it may be; but the introduction of such sordid necessity must and does rob sledge-travelling of much of its glory. In my mind no journey ever made with dogs can approach the height of that fine conception which is realised when a party of men go forth to face hardships, dangers, and difficulties with their own unaided efforts, and by days and weeks of hard physical labour succeed in solving some problem of the great unknown. Surely in this case the conquest is more nobly and splendidly won.

Thus, Captain Scott, the utilitarian was born, and with this notion he persisted to the very end. However, was he right? The answer is negative on many counts.

One more time, Captain Scott grabbed someone else's idea or advice, and without any scrutiny whatsoever used it for own plans. Captain Scott only superficially

understood the notion of utilitarianism. Most importantly, Captain Scott did not understand the origin of utilitarianism and in what circumstances it was applicable. Certainly the concept of utilitarianism was developed during the industrial and post-industrial revolution when the British society slowly became an industrial society living predominantly in communities and towns located near factories. Under these circumstances, less and less animal power was used and even when used the animals were not driven to the degree that caused their deaths. Sustained animal usage and performance was economically sound, and did not require support from utilitarianism. A good proof of the validity of sustained animal usage was and is the ancient and common practice of Inuit dog sledging. Thus, the utilitarian notion of the largest possible balance of pleasure over pain or the greatest happiness of the greatest number was readily achieved and followed in the societies suited for it.

However, direct transfer of the above utilitarian equilibrium between pain and happiness to Antarctic exploration, and more importantly to the challenging South Pole journey, was simply incorrect. No one, including Captain Scott, presented theoretical calculations that dog sledging to the South Pole could be used in utilitarian equilibrium. Such a proof could rely on a calculable logistic of the journey, providing sustainable sledging velocities, required and sufficient food/fuel rations for humans and dogs, contingency plans, initial depôt distribution and re-supply options. And all of that under the assumption that *all* dogs will return and will not be sacrificed to feed people and fellow dogs. I challenge the investigative reader to present such estimations not *necessarily* assuming five people reaching the Pole, two people would suffice.

At many occasions since Captain Scott received the challenging news from Captain Amundsen, he could pick up the gauntlet. While I wait for the above advised logistic calculations by the investigative reader, let me just point out that even at the foot of the Beardmore Glacier in December 1911, Captain Scott could re-arrange his sledging plan.

It is not clear from Captain Scott's writings and records what exactly he was planning in regards to usage of ponies during the South Pole journey. On Dec. 9th, 1912 Captain Scott at what was later known as Shambles Camp noted

> We camped, and the ponies have been shot. Poor beasts! They have done wonderfully well considering the terrible circumstances under which they worked, but yet it is hard to have to kill them so early [*sic*]. The dogs are going well in spite of the surface, but here again [*sic*] one cannot get the help one would wish. (T. +19°) I cannot load the animals heavily on such snow.

Indeed, Captain Scott is telling us that he was *planning from the very beginning* to drive ponies as far as possible, and then shoot them since no hay bales were stored at returning depôts, including One Ton Depôt. Captain Scott and the others from his party did not have any utilitarianist scruples whatsoever towards the ponies. After all, to Captain Scott, wild ponies belonged to domestic ungulates and were eatable.

Since Captain Scott planned to not have the ponies return, he must have planned that their meat or whatever will be left from the "poor beasts" would be eatable by men and dogs. We know as it was discussed in subsections 9.4 and 11.1.10 that on Captain Scott's return from the Pole, the party almost entirely neglected pony cutlets at Shambles Camp, plus elsewhere on the return journey.

For my thesis, it is sufficient to state here that Captain Scott did not present such a logistic analysis and formulated the unfounded conclusion that it is impossible to

reach the South Pole using dog sledging as the main transportation method, and using utilitarianist equilibrium. In other words, Captain Scott did not prove (or even attempt to prove) that the utilitarianist equilibrium logistic of dog sledging to the South Pole is impossible or close to impossible.

In a way and quite well before even thinking about the next expedition, *the Terra Nova Expedition*, Captain Scott *irreversibly* defined his position on dog usage by assuming that the exploration of Antarctica *must* be achieved only by means of his selective utilitarianist equilibrium.

This false, unsupported and tacit assumption by Captain Scott was also held up by another untested and unsupported assumption, that "there are places where men can go but dogs cannot … rough uneven glaciers".[34]

These both unjustified and false assumptions, formulated in writing right after the *Discovery Expedition*, virtually closed all pleasurable exploration methods equally for Lt Shackleton and Captain Scott.

Neglecting particularities of Lt Shackleton's *Furthest South* journey, one rightly may observe here that Captain Scott while planning his *South Pole Journey* did not present a utilitarianist equilibrium logistic for ponies and men. Only dogs were "not to be risked" but ponies, and by the possibility of hazard, men were to be driven to their deaths. Indeed, a peculiar utilitarianist approach when, as Captain Scott noted in his *Message to the Public*, men takes "all risks which had to be undertaken" while elsewhere the dogs are "not to be risked".

The question why the dogs under Meares and Dmitrii's command outperformed dog sledging performance during the *Discovery Expedition* never occurred to Captain Scott or anyone else during the Barrier stage of the *South Pole Journey*. Even more strangely, it never occurred to anyone to remember the striking success of dog sledging during the resupplying of Bluff Depot during the *Nimrod Expedition*.[35]

Thinking in the above terms, one inevitably gets the feeling that indeed something is missing in Captain Scott's account of his South Pole journey. This something is not particularly mysterious or hard to understand. It is indeed simple and expressed in the question: why did Captain Scott or Lt Bowers or Dr Wilson not ask Meares or Dmitrii how much food was given to the dogs? Since Captain Scott was a vivid dog utilitarianist, it could be natural for him to figure (search for) the reason for the dogs suffering and killing during his *Southern Journey* by asking Meares.

It was Captain Scott's decision in November 1911 to take dogs further than originally planned. How then was this decision taken? No thought was given by Captain Scott and Lt Bowers on how to accommodate dog food rations? If not, then Captain Scott did not care about the dogs, and if yes then Captain Scott did not care about the truth and hid it from future explorers. Either way, it was wrongdoing from a utilitarianist point of view. Thus, Captain Scott placed himself and his expedition in an awkward situation.

While the dogs in England were highly appreciated pets and non-consumable animals, their role back home was not transferable to Antarctica and its exploration. Using Captain Scott's data during the *Terra Nova Expedition* one can get rough figures for the self-sustained sledging times of an only man, only dog, and the only pony to be 100, 63 and 55 days, respectively.[36] These rough figures are sufficient to understand the physical limits of Antarctica exploration in the early twentieth century. They also

define the limits of utilitarianism in Antarctica. Evidently, they were not observed by Captain Scott who pushed ponies to their deaths.

As far as we know, Captain Scott was the only one who wrongly treated dogs in Antarctica as pets. It was not so in Captain Amundsen's case. Neither was it in Lt Shackleton's case, who during the *Endurance Expedition* commented[37]

> The last two teams of dogs were shot to-day (April 2), the carcases being dressed for food. We had some of the dog-meat cooked, and it was not at all bad – just like beef, but, of course, very tough.

Bon appétit and ahoy! By endurance we conquer.[38]

12.1.2. Enough Scientific Tilt to be Convenient

Right from the *Discovery Expedition*'s early preparation stages, Captain Scott participated in a fast learning tour of not only polar exploration methods, but also in a tour of social power games and what we would call today public relations. After all the notion of how to use another human fellow for one's own pursuits is ancient and certainly everlasting.

While thinking about Captain Scott's *Terra Nova Expedition*, one should avoid *presentism* by differentiating how the expedition was understood during its preparation, execution, and early post-expedition accounts with the later historical accounts. Therefore, the unavoidable question of similarities and differences between Captain Scott's first and second expeditions arises. In here, I am not interested in enumerating these issues. I am interested in understanding how the relationship between adventure and research in Antarctica during the *Discovery Expedition* influenced Captain Scott's decisions during the *Terra Nova Expedition*.

In 1899 an *Antarctic Executive Committee* was set up to work toward launching an expedition to Antarctica. The Committee was represented by four people: Captain Thomas H. Tizard and Dr Edward B. Poulton on behalf of the Royal Society, and Sir Clements Markham (Chairman) and Sir R. Vesey Hamilton on behalf of the Royal Geographical Society. The instructions allowed the Committee to make recommendations for the appointment of executive and scientific staff for the expedition. At that time, two people appeared worthy of consideration to become the scientific leader of the expedition. The first was William S. Bruce; Scottish naturalist, polar scientist and oceanographer and the second was John W. Gregory; a British geologist and explorer. Due to disagreement with Sir Clements over Bruce's position during the expedition, Bruce declined and soon after launched his own scientific expedition known as the *Scotia Expedition* (1902–1904). Sir Clements did not remain in depth and commented, "I am very sorry to hear that an attempt is to be made in Edinburgh to divert funds from the Antarctic Expedition; in order to get up a rival enterprise".[39]

In the meantime, Dr Poulton, one of the Royal Society representatives in the Committee, was pushing John Gregory's candidature for the scientific leader of the expedition. However, Sir Clements wanted his way, the Royal Geographical Society way and outmaneuvered Dr Poulton, leading to Dr Gregory's resignation and the then Lieutenant (soon to be Commander) Robert F. Scott's nomination as leader of the expedition. A rancorous Dr Poulton commented[40]

> The resignation of the man [Gregory] who is, before all others, fitted to be the Scientific Leader of the National Antarctic Expedition will lead the fellows of the Society to expect some statement of the causes which have produced a result so disastrous to the interests of science. The following statement gives an account of the efforts which have been made to prevent the injury which has occurred.

Dr Poulton also objected to the expedition being modified into the model that Robert Peary later defined and Captains Amundsen and Scott employed.[41]

> … D[d]uring 1900–1, it become apparent that there was strong element in the RGS led by Markham, who regarded the chief aim of the expedition to get a British party to the South Pole before any other nation (rather than scientific research). *This meant disregarding any research which may hinder getting to the pole first, even though the raising of the expedition's founding had been based on the clear brief of scientific research.* [emphasis mine] The conflict that this engendered split the Joint Committee. In simple terms the RS stood for the research, but did not defended it with any spirit, and the RGS for the exploration that would require reaching the Pole … Scott, who had no scientific training or expertise, had never led any expedition anywhere, had experience in polar travel or skiing, had been chosen preliminary to lead the race to the Pole and bring the glory to the navy and nation.

Despite these skirmishes, a sufficient amount of monies and commercial sponsors was raised, and *RRS Discovery* left the Isle of Wight on Aug. 6th, 1901 with *Instructions to the Commander*, Commander Scott, describing the expedition's objectives.

Upon his return from Antarctica, Commander Scott and his party received wide recognition by the King and various societies across Europe, including his promotion to Captain. Suspiciously, the Royal Society kept a low profile in expressing appreciation of the scientific work of Captain Scott's expedition. Captain Amundsen would suffer a similar delay from the RGS in expressing appreciation for his facilitation of science in his *Northwest Passage Expedition*, but he would get away without any damage. When the Royal Society was ready to strike back, it was a question of time and greatest effectiveness of the attack.

In section 1.5, titled *Meteorological Games – False Charges Against Lt Charles W. R. Royds*, I presented an analysis of baseless questioning of Lt Royds' meteorological (wind directions) record by the Director of the Meteorological Office Dr William Napier Shaw and certain associates, all of them related to the Royal Society.

One more time, the message to Captain Scott was clear: his success during the *Terra Nova Expedition* will depend on combined issues of reaching the South Pole and returning with scientific data. Reaching the South Pole was important for everyone, but in particular for the mob. Returning with scientific results *was not* important to most of the scientific establishment as discussed in section 1.5, but important for power games and influences. Unsubstantiated questioning of explorers' achievements fit the genre of power game.

Captain Scott, aided by Dr Wilson, forced Lt Shackleton not to use his private ground at McMurdo Sound. Sir Clements questioned Lt Shackleton's *Furthest South* result[42] and Lord Curzon laughed at Captain Amundsen for prizing his dogs.

The importance of public perception of Captain Scott and his expedition, and in particular his planned attempt to conquer the South Pole, was exemplified by the tantrum reactions of the press upon learning of Captain Amundsen's plans. One American article published on May 7th, 1911 and titled *Gallant Captain Amundsen's "Unclubby" Pole Hunt* illustrates the lack of knowledge and hypocritical hype[43]

> Capt. Amundsen's Five Bad Breaches of Polar Etiquette.
> He has landed on the same side of the Continent as Captain Scott.
> He has set out for the Pole without giving previous notice of his intention.
> He has started eight months before Captain Scott intended to do so.
> He has gone in great haste at the most dangerous season of the year.
> He is trying to turn the "gentlemanly sport" of pole hunting into an "undignified scramble".
> There is great excitement in polar circles. Polar etiquette has been grossly violated. One explorer is walking on another explorer's continent, in violation of the rules, and now that the first breach has been committed, there is no knowing how many explorers will be using the same continent contrary to the rules.

It is impossible to rationally assess the above citation and the rest of the article. However, I am bringing it to the reader's view to show that the public was heavily pounded by a media blizzard of fabrications and cheap sensationalism, possibly increasing newspaper sales but eradicating commonsense thinking.

In summary, I am saying that at least, Captain Scott and Dr Wilson were very much aware of the importance of reaching the Pole, producing an obligatory amount of scientific data, and post-expedition public relations with institutions and the mob.

Reaching the Pole and producing scientific data during the expedition were the two tainted-with-utilitarianism pillars of Captain Scott's *Deus ex Machina*. Changing emphases on the Pole or science provided an explanation for events, and enabled Captain Scott to account for various mishaps.

12.2. Captain Scott's "*Message to the Public*": Submission to Nature, Nation and Deity?

> *Scott's 'Message to the Public' remains one of the most remarkable documents in British history: part apologia, part heroic testament, part anguished plea for the bereaved.*
>
> Max Jones[44]

Indeed after reading Captain Scott's journal, and especially his description of the South Pole Journey and the last entry entitled as a *Message to the Public* which summarizes the journey in the most appealing way, one is deeply moved. It is not clear exactly on which day in March 1912 if not before it was written by Captain Scott. For many like Dr Jones and Hilton Young[45], the *Message to the Public*

> [It] moves forward with certainty, swiftness, and concentration. There is hardly anything but direct statement of events; there is little or no introspection; and yet it expresses every mood of the party. There is no ornament, no elaboration, no effort at effect; and yet it is beautiful and powerful, with the pre-eminent beauty and power of sincerity.

Oh, if only Captain Scott's *South Pole Journey* was dependent on literary skills, then Dr Jones and Mr Young's (1st Baron Kennet) accounts might be right. However, for some analytically (practically) minded readers, the *Message to the Public* does not represent a literary pamphlet, but a field report summary. As such, and if the South Pole Journey was at least in part a scientific exploration, it should contain certain verifiable information and/or data. If this is the case one could investigate these bits of information to determine the "sincerity" of the *Message to the Public* and thus Captain Scott's account, not its "pre-eminent beauty".

Captain Amundsen, in his telling book entitled *My Life as an Explorer*, in 270 pages described his geographical exploits. In a chapter modestly entitled *Dash to the South Pole,* he spent 13 pages, just about 5% of the book's entire content, to describe events. He plainly observed[46]

> Scott and his companions died on their return from the Pole, not from broken hearts over our earlier arrival, but from actual starvation, because of their inability to provide adequately for food on the return trip. This difference between the two expeditions was exactly the difference between dogs and other means of transportation.

However, Captain Amundsen's conclusion is not correct. In section 9.4 and subsection 11.3.1, I showed that the Captain Scott party's food shortages did not occur, at least for the majority of March 1912.

Three years before the *Message to the Public* was written, Lt Shackleton was about to turn back short of 97 miles from the South Pole and he observed[47]

> Man can only do his best, and we have arrayed against us the strongest forces of nature.

Similarly, Captain Scott in his *Message to the Public* explained

> I maintain that our arrangements for returning were quite adequate, and that no one in the world would have expected the temperatures and surfaces which we encountered at this time of the year.

In both cases, the explorers "arrayed" themselves against unpredictable and ferocious forces of nature. Because of that, Lt Shackleton was forced to turn back and Captain Scott perished. In short, nature was the main culprit and the only enemy. Their goals were without doubt achievable, and only hostile nature led to premature return and disaster, respectively. Only nature with her impossible to understand and predict features was to be blamed. Can anyone blame an inanimate nature?[48] The answer, at least in the case of Captain Scott's *South Pole Journey*, is affirmative. His team subordinated to nature and its modes. More importantly, Captain Scott could not cope with nature. He was fighting back as if he could influence blizzard duration, temperature, friction, *etc*.

The scary part of the relationship between Captain Scott and Antarctica's nature is that one more time he confused fundamental issues and *anthropomorphized* Antarctica's weather. I partly discussed Captain Scott's usage frequency of various words in his narrative in section 2.1. In here let me only point out that during the *South Pole Journey* Captain Scott used the word *weather* about 86 times out of a total number of about 208 times during the whole expedition. The usage tilt is evident. However, I am not concerned with it here, but rather with the way Captain Scott anthropomorphized the weather. Here are some of these entries from his journal during the *South Pole Journey*

> [Nov. 11th] It is difficult to make out what is happening to the weather it is all part of the general warming up, but I wish the sky would clear.
>
> [Nov. 12th] The weather was horrid, overcast, gloomy, snowy. One's spirits became very low.
>
> [Nov. 13th] I trust the weather and surface conditions will improve; both are rank bad at present.
>
> [Nov. 15th] It is very interesting to watch the weather phenomena of the Barrier, but one prefers the sunshine to days such as this, when everything is blankly white and a sense of oppression is inevitable.
>
> [Nov. 28th] The general impression of all this dirty weather is that it spreads in from the S.E.
>
> [Dec. 2nd] In fact everything looks well if the weather will only give us a chance to see our way to the Glacier. Wild, in his Diary of Shackleton's Journey, remarks on December 15, that it is the first day for a month that he could not record splendid weather. With us a fine day has been the exception so far.
>
> [Dec. 4th] … it makes me feel a little bitter to contrast such weather with that experienced by our predecessors.
>
> [Dec. 5th] What on earth does such weather mean at this time of year?
>
> [Dec. 7th] I cannot see that any plan would be altered if it were to do again, the margin for bad weather was ample according to all experience, and this stormy December our finest month is a thing that the most cautious organiser might not have been prepared to encounter.
>
> [Dec. 22nd] The weather has been beautifully fine all day as it was last night.
>
> [Jan. 14th] So close it seems [the South Pole] and only the weather to baulk us.
>
> [Jan.18th] It looks as though the Norwegian party expected colder weather on the summit than they got; it could scarcely be otherwise from Shackleton's account.
>
> [Jan. 25th] The weather still looks unsettled, and I fear a succession of blizzards at this time of year

> [Feb. 6th] Food is low and weather uncertain, so that many hours of the day were anxious …
>
> [Feb. 7th] We deserve a little good bright weather after all our trials
>
> [Feb. 16th] … but the weather is all against us.

It evident that Captain Scott anthropomorphized the weather by gradually developing the false notion that "the weather is all against us". However, such thinking is wrong and unscientific. The weather is a bound random variable. The weather patterns, though quasi-stable, also exhibit certain fluctuations.

Over many years, people observing the weather were able (and interested) to develop weather lore expressed in folklore proverbs, which were simple and frequently effective weather predictions. Obviously no such weather lore was available to Captain Scott, and his impersonated thinking about weather events during the *South Pole Journey* was wrong and unsubstantiated. But it goes beyond that. By saying that "the weather is all against us" Captain Scott tacitly was assuming that the weather could and should cooperate with his sledging effort. Of course, *either* way Captain Scott was engaging in wrong thinking about the weather. During the Gale at 83°S (see subsection 11.1.6) Captain Scott on Dec. 7th noted

> I can find no sign of an end, and all of us agree that it is utterly impossible to move. Resignation to misfortune is the only attitude, but not an easy one to adopt. It seems undeserved [*sic*] where plans were well laid and so nearly crowned with a first success. I cannot see that any plan would be altered if it were to do again, the margin for bad weather was ample according to all [*sic*] experience, and this stormy December [in the original MS, it was "storm in December," an edit of exaggeration which Dr Max Jones deliberately concealed from his list of changes to the published version – KS] our finest month is a thing that the most cautious organiser [*sic*] might not have been prepared to encounter.

I picture how the investigative reader[49] must be smiling at Captain Scott's account, especially after reading previous chapters. Indeed, one wonders why Captain Scott was made "undeserved" by nature and high winds going down from the Beardmore Glacier. His "all experience" was limited to *two data points*, his own and Lt Shackleton's. On what basis is it possible to deduce about climate conditions at this particular location? Nothing, indeed *nothing* educated can be figured and a "cautious organiser" should allow weather delays in their sledging plan. Certainly it was not present in Captain Scott's scheme of the 144-days sledging journey[50] with a sustained sledging velocity of 10.1 miles per day.

Equipped with my findings described in the previous chapters and re-reading the *Message to the Public* with newfound scrutiny, one may find that Captain Scott's real intention was to obfuscate the public. The main verifiable causes of disaster mentioned by Captain Scott in the *Message to the Public* which *were not confirmed* may be summarized as follows:

A. The events which took place but did not contribute to disaster:
   1. The loss of ponies in March 1911 (see subsection 11.1.1),

   2. Gale at 83°S (see subsection 11.1.6),
   3. Soft snow at Beardmore Glacier (see subsection 11.1.7).
B. The events which did not occur:
   1. Feb. 27th through Mar. 27th, 1912 – *Extreme Cold Snap* and *Super Extreme Cold Snap* (see Chapter 7 and subsection 11.3.3),
   2. Mar. 21st through 29th, 1912 – *Never Ending Gale* (see Chapter 8 and subsection 11.3.4).
C. The events which only toward the very end of March could lead to the party's deaths:
   1. Food shortages on the Barrier (see section 9.4),
   2. Fuel shortages on the Barrier (see section 9.4).
D. False notion of last camp location:
   1. The 11 miles myth (see subsection 10.6).

Taking into account the above-enumerated causes of Captain Scott's disaster which *did not take place*, one must conclude that only a very few lines in the *Message to the Public* remain untouched and substantiated. What is left indeed of Dr Jones' "anguished plea for the bereaved"? Not much indeed for investigative readers, who at this moment may consult the Appendix to the current Chapter and subsection 12.2.1 to see what is left from Captain Scott's *Message to the Public* if its unfounded entries are removed.

Looking at Captain Scott's *Message to the Public* stripped of unfounded and unconfirmed accounts, Dr Jones' one of "the most remarkable document[s] in British history" remarkably is not a "part apologia" and not a "part historic testament". What it is then? Captain Scott's *Message to the Public* is a hoax. Like every hoax, the *Message to the Public* has some true elements (statements). However, the building elements like "the causes of the disaster" are unfounded and fake. Additional pillars of the Message like the weather events and food/fuel shortages are also Captain Scott's invented story.

12.3. Resurrection of Captain Scott's *Deus ex Machina*

You were bold, Uncle William [Dr Wilson],
that journey to make,
Setting blizzards and cold at defiance,
Cape Crozier to seek, the Hut to forsake,
You're a regular martyr to Science.

Edward W. Nelson[51]

It is extraordinary how the post-expedition analyses and public understanding of the *South Pole Journey* precisely followed Captain Scott's wishes and intentions which had crystallized during the return leg over the Antarctic Plateau, and concerned how his journey and expedition should be remembered. Captain Scott's *Deus ex Machina*.

In section 12.2 of the current chapter I presented, invited by Captain Scott's *Deus ex Machina*, a description and thus understanding of the principal aims of the *Terra Nova Expedition*. It appears that these who wanted to hear that the expedition was about science heard exactly that. And these who wanted the South Pole heard exactly

about adventure. The point was made clearly by the man who had been the second-in-command of the *Terra Nova Expedition* Captain Evans[52]

> We should never have collected our expeditionary funds merely from the scientific point of view; in fact, many of our largest supporters cared not one iota for science, but the idea of the Polar adventure captured their interest. On the other hand, a number of our supporters affected a contempt for the Polar dash and only interested themselves in the question of advanced scientific study in the Antarctic.

Captain Evans' words are easy to misuse as proof that the South Pole was just bait for public support. However, they carry a hidden edge. These conditions described by him would have from the beginning determined Captain Scott's potential expedition objectives. This certainly does not mean that a primarily South Pole conquering expedition was automatically ruled out in the beginning. Captain Evans's account is synonymous to Captain Scott's own account of the *Terra Nova Expedition* presented in 1910 before the Royal Geographical Society, immediately before my previous quotation of it at the beginning of this chapter

> There is unfortunately a sharp difference of opinion as to the value of Polar exploration, and as to the results of Polar expeditions. The general public, whose knowledge of such matters is derived from the sensational press, can count success only in degrees of latitude … Within these limits there is every shade of opinion as to the relative value of the objects to be pursued, and beyond them is, and I fear will ever remain, the class which sees no good at all in Polar exploration. Excepting this last, I would express the opinion that there is much to be said for all points of view.

However, Captain Evans' view was not shared by Scottish naturalist, polar scientist, and explorer Dr William S. Bruce (organizer and leader of the *Scottish National Antarctic Expedition 1902–04*), who as early as 1911 indirectly explained the roadblock that Captain Scott must have run into in the early days of organizing his expedition[53]

> I say purposely traversed, for many parts traversed have not been explored. A race across Africa, from Paris to Pekin [*sic*] on a motor car, or what has been aptly called the "boyish Pole hunt", can now no longer be regarded as serious exploration. In fact, in Polar exploration especially, people are beginning to see the comparative uselessness of such journeys, and rarely can any Polar expedition get money unless the leader announces that such and such scientific investigations are to be made by a staff of experts, and that such and such scientific results are likely to accrue.

and continued with insightful prophecy

> Yet what the mass of the public desire is pure sensationalism, therefore the Polar explorer who attains the highest latitude and who has the powers of making *a vivid picture of the difficulties and hardships involved will be regarded popularly as the hero* [emphasis mine], and will seldom fail to add materially to his store of worldly welfare; while he who plods on an unknown tract of land or sea and works there in systematic and monographic style will prob-

> ably not have such worldly success, unless his business capacity is such as to allow him to turn to his advantage products of commercial value in the lands and seas he has been exploring.

By 1967, nothing had changed from Bruce's observation of the science roadblock, as would-be North Pole conqueror Ralph Plaisted (1927–2008) found out the hard way[54]

> They [National Geographic Society – KS] said I wasn't planning to do enough scientific stuff. I said I was planning to go to the North Pole, wasn't that enough? They said nobody could just take a few cronies and go to the North Pole. I told them they could just sit there and watch me.

Ralph Plaisted had the last laugh two attempts later.

Keeping presentism at bay, let me recall that both Captain Scott and Dr Wilson understood when and how the ratio between science and adventure must be adjusted during the entire *Terra Nova Expedition*. The *Winter Journey* to Cape Crozier preceded the South Pole journey in adjusting the adventure/science tilt ratio. The *Winter Journey* had two aims: scientific to collect early embryos of Emperor penguin eggs, and adventure to test sledging equipment and food rations for the upcoming *South Pole Journey*.

At the time of actual events, for some observers Captain Scott's journey to the South Pole was understood as a pure adventure. A geographer, Dr Hugh R. Mill[55], who widely wrote on many geographical issues including Antarctica and Captain Scott's expeditions[56] and who described his relationship with Captain Scott as "we were friends at once"[57] harshly but *accurately* observed[58]

> I would gladly write … on Scott's results, but … there are none … He kept so close to Shackleton's track that he could nothing unless Shackleton had never been there … Even if Scott reached the Pole he … can accomplish nothing except to bring his party back alive.

Although these words were written almost 10,000 miles from the South Pole and three months after Captain Scott reached the South Pole second to Captain Amundsen, their meaning and importance were evident. Captain Scott could not deliver to the British Empire the pride and the Pole. "[G]good-bye to most of the day-dreams" Captain Scott sarcastically concluded.

At the time of reaching the Pole or not long after, for the second time it appeared that the party might return empty handed if Captain Scott did not use his *Deus ex Machina* trick *to re-define* (*re-describe*) his expedition. During the *Terra Nova Expedition* one can determine at least three fuzzy periods of time when the expedition in an explicit or tacit way was defined as:

- *Adventure and Pole Conquering* – this honest notion was mixed with patriotism and used when Captain Scott was preparing the *Terra Nova Expedition*, and was looking for financial backers[59] who chiefly were interested in adventure. Simultaneously, Captain Scott was using his diplomacy skills to pander to those who were interested in science,
- *Gradual Scientific Tilt* – this notion was used after Captain Scott learned about Captain Amundsen's going South, and especially after Lt Campbell's finding of the *Fram* in the Bay of Whales,

- *Scientific South Pole Journey* – this notion was created after Captain Scott lost the race the Pole.

He likely realized the potential of his *Deus ex Machina* from a proclamation made by the city of Manchester in 1910, which stated[60]

> If it is possible to succeed we feel assured that you will be the one to reach the goal and to plant the British Flag at the Antarctic Pole: but should adverse circumstances block the way we anticipate with confidence a rich harvest of scientific results, which you and your brave companions cannot fail to bring back.

These words certainly set the stage for what happened after the return journey began. On Feb. 8th and 9th the party geologized along Mt Buckley and "the main objective of the expedition and Scott's promise to the British public"[61] changed from a mixture of the first two periods to the *Scientific South Pole Journey* period. Dr Wilson's early general promise[62] that "No one can say that it will have only been a Pole-hunt … We want the scientific work to make the bagging of the Pole merely an item in the results" softy materialized itself at the foot of Mt Buckley. Captain Scott and Dr Wilson provided to posterity a venue to think and describe their effort during the South Pole journey, "scientists to the end".

Dr Atkinson's search party found at the last camp the bodies, diaries, and a pile of rocks which frame Captain Scott's expedition trinity. The bodies spoke about death and mortality. The diaries spoke about what the authors wanted to convey to the readers. And the rocks spoke to the ideal of self-sacrifice for the sake of science and scientific progress. Thus "the Southern Journey plan also included an extensive scientific programme."[63]

Thanks to this, Dr Atkinson during his search party report, instead of giving us his post-mortem (as far as it was possible and scientifically interesting) report on Captain Scott's party, in an uneducated way evaluated the value of the collected specimens[64]

> We recovered all their gear and dug out the sledge with their belongings on it. Amongst these were 35 lbs. of very important [*sic*] geological specimens which had been collected on the moraines of the Beardmore Glacier; at Doctor Wilson's request they had stuck to these up to the very end, even when disaster stared them in the face and they knew that the specimens were so much weight added to what they had to pull.

Dr Atkinson's evaluation was purely based on the fact that Captain Scott's party, for some reason, collected these rocks and dragged them all along from Mt Buckley. After all no one in his right mind could collect and drag so many rocks, some 35 ℔, if these rocks were *entirely* rubbish.

A couple of decades after Dr Atkinson's fallacious notion, an even stronger account was reported by Martin Lindsay[65]

> There are those who say that Scott made mistakes, that he should have taken dogs on the polar journey, that he should have done this or that in order to have arrived at the Pole before Amundsen. People who express such opinions are to be pitied. It is of no account who reached the Pole first. That Scott's party reached it at all only matters in so much as that they died with their task accomplished. What is of immense importance is the invincible

> courage, the unblenching fortitude that Scott and his companions displayed. The geological specimens they brought back are beyond price, but even these are worth nothing in comparison with the manner in which they were secured. Fighting for their very lives with the remorseless forces of Nature, those men clung in ever increasing peril and weakness to the data it was their duty to secure, and thus snatched victory out of the jaws of death, to perish in the moment of accomplishment. That is what counts. Had the specimens proved to be worthless lumps of granite the glory of the achievement would have been in no way diminished.

Dr Atkinson, Lindsay, and many others felt into the trap set up by Captain Scott called the aesthetic fallacy and/or cargo cult science. The aesthetic fallacy[66] is a fallacy which conveys that if something looks convincing, it is indeed convincing. In Captain Scott's case, collecting specimens at Mt Buckley looks scholarly and thus it must be taken seriously by all side observers, including Dr Atkinson. The danger of committing the aesthetic fallacy relates not to the narrator like Captain Scott, but to the readers of his diary, who falsely assume (take for granted) the scientific importance of the collected specimens. More importantly, a band of people facing very low temperatures, low food, low fuel, all difficulties as described in their diaries plus certain death, who choose to drag 35 ℔ of specimens for some 300 miles and 40 long days, must mean something *very* special.

The second or parallel to the first trap set by Captain Scott is called cargo cult science. Cargo cult science is a practice conducted by people who during their activities give the impression to others of being scientific, but do not follow in these activities some variant of the scientific method. Not only do they not follow the scientific method, they do not have an idea what the scientific method is. The concept was elicited by Richard Feynman during his 1974 commencement address at the California Institute of Technology where he explained[67]

> In the South Seas there is a cargo cult of people. During the war [World War II – KS] they saw airplanes land with lots of good materials, and they want the same thing to happen now. So they've arranged to imitate things like runways, to put fires along the sides of the runways, to make a wooden hut for a man to sit in, with two wooden pieces on his head like headphones and bars of bamboo sticking out like antennas – he's the controller – and they wait for the airplanes to land. They're doing everything right. The form is perfect. It looks exactly the way it looked before. But it doesn't work. No airplanes land. So I call these things cargo cult science, because they follow all the apparent precepts and forms of scientific investigation, but they're missing something essential, because the planes don't land.

Returning to the diary description of Captain Scott's party geologizing on Feb. 8th – 9th at Mt Buckley and later dragging collected specimens, one gets the superficial impression that these actions had a perfect scientific investigation form. What, then, was the scientific method for collecting specimens? We do not have to look too far to find the answer. The *Antarctic Manual* prepared for Captain Scott's *Discovery Expedition* in the section titled *The Rules of Collecting* [*specimens*] describes at least a part of a scientific method for collecting[68]

> In collecting fossils, it is useless [*sic*] to take many specimens of one kind unless carriage [*sic*] is exceptionally plentiful. Two or three good examples of each kind are usually sufficient, but as many kinds as possible should be collected.

The above method of specimen collecting described in the *Antarctic Manual* for Captain Scott's *Discovery Expedition* is scientifically sound as "two or three good examples of each kind are usually sufficient". Therefore, Captain Scott's 35 ℔ of specimens represent cargo cult science. In contrast, one must observe that Lt Shackleton and Charles Wright (Silas) while collecting specimens followed *exactly* the rule given in *The Antarctic Manual*. For more on that, see *Event 4* in subsection 12.4.1.

Recently in the advent of Captain Scott's centennial of reaching the South Pole (1912–2012), a new surge of different media publications was created. It will be too tedious and unproductive to review most of them to prove my thesis. Therefore, I will just pick the most representative account of Captain Scott's *Terra Nova Expedition* which provides the evidence of my notion.

A fine example of changing the perspective on Captain Scott and the *Terra Nova Expedition* was presented in Cambridge Alumni Magazine (CAM) by Dr Julian Dowdeswell, Director of the Scott Polar Research Institute (SPRI) and Professor of physical geography at the University of Cambridge. In a one-page letter titled *Right to Reply: Heroes Frozen in Time*, Professor Dowdeswell exercised the right to respond to CAM's earlier published article by Lucy Jolin[69] who describes herself as a person who has written "about everything from quantum cryptography to deluge myths".[70] Obviously her article delivers nothing new and is a simplistic recycling of negative notions attributed to Captain Scott. Nevertheless, Jolin concluded in well-known form

> I'd say Scott was probably the most incompetent polar explorer who ever tried his luck in the Antarctic. He is the romantic hero, where you have to suffer.

Professor Dowdeswell felt obliged to respond when in his own backyard's magazine someone was menacing Captain Scott's legacy, and pseudo-authoritatively declared[71]

> Research findings from Scott's two expeditions are still quoted in today's scientific literature.

Again and again we hear how Captain Scott's expedition research findings are quoted in today's scientific literature (publications). And again in vain one runs to the library to fruitlessly look for these quotations, since seemingly some of them are bound to be false citations. A certain scarcity of printing space at CAM did not permit Professor Dowdeswell to list all of these citations; however a link to SRPI's website with such a listing would satisfy the reader's hunger for knowledge and also would suffice for the scientific method of presentation enabling the reader to examine the scientific publication results and conclusions.

Further in her article, Lucy Jolin asks a seemingly investigative question

> How do you measure ice loss? It can be as simple as comparing two photographs, says Dowdeswell. A hundred years ago Scott took a photograph of a lake trapped by a glacier around 55 miles from where McMurdo research sta-

> tion now stands. Recent photographs of the same place show a dramatic drop in the lake's levels. Generally, however, measuring loss is a complex process.

And again we are in a Cherry Picking Fallacy trap, whose "application" to Captain Scott's records I extensively discussed in Chapter 4 in relation to Dr Solomon's fallacious analyses. In here, Professor Dowdeswell is telling us that by comparing "two photographs"; one taken today and another one taken by Captain Scott, one could scientifically or otherwise "measure ice loss". Indeed, it is a cargo cult science statement.

And this cherry picking/cargo cult science will not go away. Its latest example[72] uses its own brand of briefly mentioning limitations before hand waving them away to state that we can take isolated ecological and meteorological records from 1911, and apply them to comparisons with the present day, since "[r]ather than seeing these methodological and vocabulary differences as insurmountable problems, however, it is probably best just to be aware of the issues they raise and move on with the research".[73]

The other telling example of resurrecting Captain Scott's *Deus ex Machina* was presented by the Natural History Museum (NHM) during the exhibition titled *Scott's Last Expedition*. The exhibition was supported by the web publication of an NHM article titled *Scott's South Pole Expedition Science Legacy*. The author, Yvonne Da Silva[74], before listing the *Terra Nova Expedition* scientific record informs the readers that[75]

> The *Terra Nova* expedition had the largest team of scientists that had ever visited the Antarctic continent. The team of 12 [*sic*] scientists included 2 biologists, 3 geologists and 1 meteorologist.

The number of 12 scientists participating in the *Terra Nova Expedition* is of course – and as we had become accustomed to – exaggerated. The mindless figure of 12 scientists quite probably comes from Huxley and Cherry-Garrard's equally meaningless division of participants in the expedition: into Officers, Scientific Staff and Men. Their faulty division is reproduced in here in Table 10.4 and the reader can consult it. In my understanding, the following fellows from this Table can be called scientists: Simpson, Taylor, Nelson, Debenham, Wright and Priestley. The remaining people: Ponting, Meares, Day, Cherry-Garrard and Gran in no way were scientists. Perhaps Cherry-Garrard wanted to see himself as a scientist. However, since he could not learn how to use and follow a compass, his aspirations and pathetic comments like[76]

> There are many reasons which send men to the Poles, and the Intellectual Force uses them all. But the desire for knowledge for its own sake is the one which really counts and there is no field for the collection of knowledge which at the present time can be compared to the Antarctic.

are empty handed.

Thus, the Natural History Museum figure of 12 scientists is reduced to only 6. The investigative reader may notice that I did not include Dr Wilson in my own *Terra Nova Expedition* list of scientists. The reason is that Dr Wilson was a physician and painter with certain scientific interests. Captain Scott characterized Dr Wilson in the following words[77]

> In addition to his medical duties he was appointed vertebrate zoologist and artist; in the first capacity he dealt scientifically with the birds and seals, and in a manner which his appendix to this work indicates; in the second

> he was perhaps still more active, and it would take long even to number all the pictures and sketches he has produced of the wild scenes amongst which we lived.

Even if my thinking about Dr Wilson is questionable and he should be included in the scientist group of the *Terra Nova Expedition*, doubling or almost doubling the actual number of scientists is unacceptable and a great distortion of reality. The direction of this exaggeration is obviously to impress the viewers of the exhibition that Captain Scott's *Terra Nova Expedition* was scientific expedition lead by dozen scientists.

Right after this "unfortunate" exaggeration Da Silva lists four scientific *achievements of the expedition:*

- Specimens collected,
- Antarctic studies,
- Emperor penguin eggs,
- Extinct plant fossil.

Besides the fact that the penguin eggs proved nothing and Dr Parsons concluded that "penguin embryos collected by Dr Wilson party at Cape Crozier rookery did not greatly add to our understanding of penguin embryology"[78], Da Silva throws in an additional point that

> They [Captain Scott expedition] produced the **longest unbroken record** [*sic*] of meteorological data for Antarctica, which remains the baseline for modern records today.

Yet again, Da Silva makes a totally wrong statement. A tedious search of usage of Captain Scott's *Terra Nova Expedition* of temperature data by researchers reveals that these data effectively were used in three papers (works): (1) Dr Solomon, (2) Dr Jones[79] and (3) my own work. Dr Solomon's worthless studies of the temperature record of the *Terra Nova Expedition* are precisely described in Chapter 4. In the Appendix to Chapter 12 and section 12.3 of the current chapter, I will briefly discuss pertinent aspects of Drs Jones' and Solomon's contributions. I will show there that the conjectures formulated by these authors conjunctures are incorrect, and that *unfortunately* for scientific progress, Captain Scott's temperature data cannot be used in advancing scientific understanding of temperature fluctuations in the Ross Island region.

⋮

From the very moment when Dr Wilson conceived his interest in collecting Emperor penguin eggs at the Cape Crozier rookery, it pompously and without regard to science appeared to him that it could be[80]

> … the biggest scientific breakthroughs [*sic*][81] of the 20th century, by providing the link between dinosaurs and birds.

However, while looking at the events during the *Winter Journey* to Cape Crozier (June 27th through Aug. 2nd, 1911) one inevitably must ask two basic (initial) questions, which were not addressed by Dr Wilson. One of these questions is why the journey was launched, and the other is what resulted from this journey? While asking

these questions, one must also picture that the journey that these questions hinge on was in the middle of the Antarctic winter.

Quite a number of polar enthusiasts will simply say that the journey's scientific purpose was according to the Editor of Dr Wilson diary[82]

> … to secure eggs at such a stage as could furnish a series of early embryos by which alone the particular points of interest in the development of the bird could be worked out; for it seemed probable "that we have in the Emperor penguin the nearest approach to a primitive form not only of a penguin, but of a bird."

In the early and middle of the nineteenth century, technical improvements of microscope resolution enabled researchers to study tiny embryos in more and more detail. German researchers Heinz Ch. Pander (1794–1865), Heinrich Rathke (1793–1860), and Karl Ernst von Baer (1792–1876) laid down the foundation for what is called comparative embryology. It was not long after the publication of *On the Origin of Species* in 1859, when Darwin's ideas would find their way into analyzing findings of comparative embryology. Indeed, not long after its publication, German polymath and prolific scientific writer Ernst Haeckel (1834–1919) advanced Darwin's hypothesis related to embryos. Dr Haeckel's thesis was that the development of an embryo revealed the adult stages of the organism's ancestors. His thesis, sometimes called *ontogeny recapitulates phylogeny*, suggested that the growth of embryo re-enacts changes *via* certain stages that resemble (recapitulate) a given species' ancestors.

In order to substantiate his thesis, Dr Haeckel not only published his studies (see for example Fig. 12.2) but also extensively lectured on the subject and on the subject of human origin and development. In 1867, Thomas Henry Huxley already considered (proposed) birds as derivatives of reptiles. Two years later he enlisted 35 characteristics as "evidence of the affinity between dinosaurian reptiles and birds" and commented[83]

> And if the whole hind quarters from the ilium to the toes, of a half-hatched chicken could be suddenly enlarged, ossified, and fossilized as they are, they would furnish us with the last step of the transition between Birds and Reptiles; for their would be nothing in their characteristics to prevent us from referring them to the Dinosauria.

From Dr Wilson's above cited purpose of the *Winter Journey* to Cape Crozier to find the embryonic development of Emperor penguins, one must immediately observe that a brief visit and egg collection at the rookery would likely produce only a *snapshot* of embryonic development. Since the eggs were laid at about the same time, in Dr Wilson's mind the obtained embryos should have been thought to provide little or no information about *changes* and embryo features at *different* stages of development.

Dr Wilson's party collected five eggs; however two eggs were lost on the way back to Cape Evans. The remaining three just before the *South Pole Journey* were briefly examined by Dr Wilson, who observed[84]

> … well formed chicks of three different sizes, fairly young, but a good deal older than I had ever expected which is all the better for my work. I got these well pickled … They are quite unique and probably the most primitive embryos of this most primitive bird.

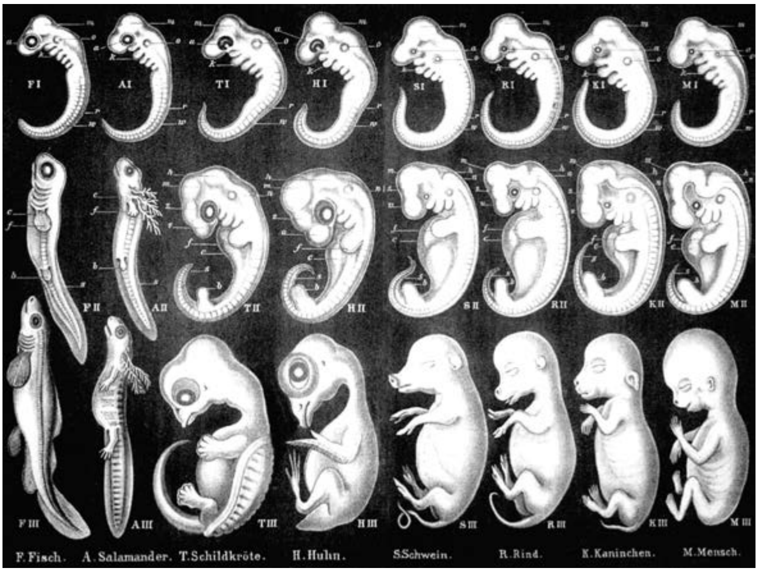


Figure 12.2. Illustration from Ernst Haeckel, *Anthropogenie*, W. Engelmann, Leipzig, 1874. While examining this figure, the investigative reader must notice that the figure was made by hand drawing.[1] Haeckel did not drag with him all of these specimens to support his notion and discovery. One more time, such a scientific procedure of results presentation is in vivid contradiction to Captain Scott's party dragging 35 ℔ of rocks to prove what one hand drawing by Dr Wilson could have sufficed for.

1 Michael K. Richardson and Gerhard Keuck, *Haeckel's ABC of Evolution and Development*, Bio. Rev. **77**(2002)495–528; Robert R. Richards, *Haeckel's Embryos: Fraud not Proven*, Biol. Philos. **24**(2009)147–154; Robert J. Richards, *The Tragic Sense of Life: Ernst Haeckel and the Struggle over Evolutionary Thought*, University of Chicago Press, Chicago, 2008.

Although it was only a preliminary examination of Emperor penguin embryos, it appears that Dr Wilson was unable to observe that feathers developed from scales. Later in 1934, Dr Wilson's initial observations were confirmed by more thorough studies of collected Emperor penguin eggs.[85] Thus, the embryos collected by Dr Wilson's party at Cape Crozier did not confirm affinity between dinosaurian reptiles and birds, but simply feather development for one species of penguin.

The investigative reader easily notices that the Drs Huxley or Haeckel's accounts did not specify at which *stage* of embryonic development the affinity between dinosaurian reptiles and birds, in Dr Wilson's case, penguins, takes place and/or is observable.

Therefore, looking at one embryo or three embryos at the same (or similar) stage of development will possibly not allow the researcher to find affinities since they may be gone or not yet appearing. Evidently, Dr Wilson forgot Dr Haeckel's *Biogenetic Law* formulated in the 1860s. That law stated that the evolution of an organism was traceable by following the organism's *embryonic development*. Ideally, one would like to examine many embryos at different stages of development. Certainly it was impossible with Emperor penguins who lay eggs in May and early June, and their rookery was some distance away from Cape Evans.

Why then was Dr Wilson stubbornly pushing for Cape Crozier? Did not he realize that at best he may get only a non-representative snapshot of embryo development? Provided that in order to get this non-representative snapshot it was necessary to embark on an almost suicidal mission, Dr Wilson's intentions must be seriously questioned.

According to Sir Ranulph[86]

> … the Emperor quest was one of Wilson's main reasons for having the *Terra Nova* expedition and both men [Scott and Wilson – KS] had intended to have their base at Cape Crozier, close by the emperor colony's site.

An attempt of landing and establishing the base camp at Cape Crozier during the *Terra Nova Expedition* was not possible at the time of arrival. Reconnaissance of Cape Crozier during the *Discovery Expedition* and Lt Shackleton's account proved that. On Jan. 3rd 1911, the *Terra Nova* approached Cape Crozier[87] and found the landing impossible. From this day, it was evident that possible research of Emperor penguins embryos must either be abandoned, or a journey in the middle of winter must be undertaken to get a few laid eggs, a mere snapshot of embryo development.

It was also known at that time that after establishing base camp at McMurdo Sound, the *Terra Nova* would proceed East along the Barrier to land the *Eastern Party* somewhere on King Edward VII Land. However, during that journey the *Terra Nova* spotted Captain Amundsen's *Fram* at the Bay of Whales and decided to turn back to Cape Evans with the news. Thus it was decided that due to the lateness of the season, the *Eastern Party* would become the *Northern Party* and would land at Robertson Bay near Cape Adare. It was known that a fairly large rookery of Adélie penguins was there, and thus was perfect ground to study penguin's embryos at various stages of development without requiring a substantial march in the Antarctic winter. Interestingly, a member of the *Northern Party*, George M. Levick, produced extensive observations of Adélie penguins during the entire breeding cycle of these birds.[88]

Since Adélie penguins breed from October through February, Dr Levick could easily collect Adélie penguin eggs at different stages of development.[89] A perplexing question arises: Why did Dr Wilson not instruct Dr Levick to collect Adélie penguin eggs at different stages of development? Why did Dr Wilson suddenly declare "We want the scientific work to make the bagging of the Pole merely an item in the results," rendering the Pole unimportant? So it was not about science and knowledge, it was about who finds out the discovery.

In addition to collecting eggs the *Winter Journey* party of[90]

> … three travellers also experimented with their sledging rations, each for some time taking a different proportion of pemmican and biscuit, the results of which were used in order to make up the rations for future use.

One more time, we come across an unacceptable lack of leadership and common sense by Captain Scott. Three men, Dr Wilson, Lt Bowers, and Cherry-Garrard were participating in an entirely uncontrollable experiment without any contingency plan. They were Captain Scott's guinea pigs to test food sledging rations. However, whatever they tested it was too little, too late, and entirely incomparable to the logistic of the South Pole journey. The *Winter Journey* party to Cape Crozier was a three-man (instead of four-man) party dragging two 8-ft sledges (instead of 1 sledge) loaded with gear and

only 6 weeks' provisions. One without particular imagination may propose to Captain Scott a much more representative and controllable testing and training ground of sledging and camping in the tent between Cape Evans and Hut Point. Of course not in the middle of winter, but perfectly feasible right after depôt laying in 1911.

The *Winter Journey* (WJ) to Cape Crozier as far as its apparent objectives are concerned may be viewed as a rough blueprint of the South Pole Journey (SPJ). Both of these journeys had two objectives:

- Practical:
  - test sledging arrangements (WJ),
  - get to the South Pole (SPJ).
- Scientific:
  - collect Emperor penguin hatched eggs (WJ),
  - belatedly collect rocks with organic imprints to perform the *Deus ex Machina* (SPJ).

Although in the case of the *Winter Journey* collection of Emperor penguin eggs was planned before the journey, one must clearly understand that collecting rocks at Mt Buckley and dragging them was thrown in during the return journey from the South Pole.

12.4. Denouement – *I Have a Tale to Tell*

Shell I refuse my dinner because I do not fully understand the process of digestion? No, not if I am satisfied with the result … First get on, in any way possible, and let the logic be left for later work.

Olivier Heaviside[91]

These were all risks incident to the enterprise [South Pole journey – KS]. *That some of them would have to be met was to be expected; the fatal peculiarity of this case was that they all [sic] had to be met.*

Martin Lindsay[92]

Based on all previous chapters in this section paraphrasing Captain Scott words *I have a tale to tell*, I will tell in a parallel manner Captain Scott's account and its new version based on my previous research. I will tell in this section what was not told by Captain Scott.

Only on the face of it was the *return* journey from the South Pole over Antarctic Plateau uneventful. The events at the South Pole were slowly creeping into everyone's consciousness. On Jan. 16th, 1912 when it was evident that "the Norwegians have forestalled" them, Captain Scott ambiguously commented "Many bitter [the word *bitter* was cut from the published version – KS] thoughts come and much discussion have we had." One can only speculate about the possible discussion between the party. What is certain is that from Jan. 16th Captain Scott and his comrades were not

as chivalrous as they had been before they learned from Lt Campbell on Feb. 22nd, 1911, that Captain Amundsen had established his base at the Bay of Whales and were ready to fight. Cherry-Garrard described these events[93]

> For an hour or so we were furiously angry, and were possessed with an insane sense that we must go straight to the Bay of Whales and have it out with Amundsen and his men in some undefined fashion or other there and then. Such a mood could not and did not bear a moment's reflection; but it was natural enough. We had just paid the first installment of the heart-breaking labour of making a path to the Pole; and we felt, however unreasonably, that we had earned the first right of way.

Eleven months later, there was no room left for calming rationalization. Only bitterness had room after discovering Captain Amundsen's black flags and the tent. Although it was a "terrible disappointment" as Captain Scott noticed, its overall importance and consequences were slowly taking place in their comprehension of events[94]

> When you put a frog in boiling water, the frog will jump out immediately. But, if you place her in a frying pan with cold water, and you increase the temperature very slowly, the frog will be unaware of the danger and will gradually adapt to its environment, until she is cooked to death. This phenomenon was under scientific investigation at the end of the 19th century. Zealous scientists argued about the optimal rate of temperature increase and the possible effect of the initial state and health of the poor animals. Anecdotal or not, the metaphor embraces a deep insight: the wisdom of how a slowly increasing load can remain unnoticed until the last small straw breaks the camel's back.

We already know from subsection 11.1.8 that due to Captain Scott's plans readjustment by taking Lt Bowers to the South Pole, the party was obliged to increase it's required daily sustained sledging velocity. The party performed quite well and arrived at depôts at expected time intervals, if not faster. However, though not at a definitive time, it become obvious to Captain Scott that like Odysseus, he was trapped between the *Scylla* and *Charybdis* of returning in personal shame, public shame, and under professional assault worse than that he had suffered from the *Discovery Expedition*; or not returning alive from Antarctica to escape the former. Mile after mile, day after day while sledging over the Antarctic Plateau, Captain Scott mulled over Odysseus' dilemma.

What *controllable* alternatives he had after losing the priority at the Pole? Indeed due to this devastating outcome and all social and personal pressures back in Great Britain, he and his comrades were in a *zugzwang* situation, seemingly obliged to answer to an unavoidable selection between two evils, *Scylla* and *Charybdis*. Unfortunately, Captain Scott was no Odysseus and could not find the middle path to escape both evils.

Odysseus' dilemma did not emerge *ex nihilo* to Captain Scott. All social pressures were upon Captain Scott's shoulders. On Oct. 28th, 1911, just a couple of days before sledging South, he wrote a surprisingly revealing letter to J. J. Kinsey, his New Zealand manager from the *Discovery Expedition* days[95]

> My dear Kinsey,- I write on the eve of our departure for the South. We shall leave with high hopes of accomplishing our object in spite of the reverses of last season.

> I am fully alive to the complication of the situation by Amundsen, but as any attempt to at a race might have been fatal to our chance of getting to the Pole at all [*sic*], I decided long ago to do exactly as I should have done had Amundsen not been down here. If he gets to the Pole, he is bound to do it rapidly with dogs, but one guesses that success will justify him [*sic*] and that our venture will be out of it. If he fails, he ought to hide! [*sic*]

If Captain Amundsen was to fail, then he, according to Captain Scott, "ought to hide!" What would Captain Scott's destiny be if he failed not only to reach the Pole, but to be the first to do it? To get financing and all the needed support, the national and imperialistic notions were exposed, stressed, and underlined quite publicly by Captain Scott from 1909–1910 in various public speeches recorded in newspapers. If not us, then who? Was not the Pole a part of "the empire on which the sun never sets"? Should not Captain Scott "ought to hide" if he failed to be first at the South Pole? Or – on the contrary to Captain Amundsen – was he immune to social pressures? Of course not, and these words from *The Times* must have burned in his mind[96]

> It would be deeply regrettable if, for want either of men or of money, the brilliant recent record of British Antarctic exploration were at this point to be checked, with the inevitable probability in such a case that the Pole would first be reached by an explorer of another nation.

Captain Scott and other members of his party went to Antarctica for various reasons, and were driven to there and the South Pole by different personal motives. These motives were not related to their *participation* in the expedition, but rather to their lives after return from Antarctica. After all, Captain Scott was not a hero in Antarctica, but in his homeland. Participation in the expedition was meant to be a vehicle to a better and desired real life at later post-expedition times, as well as a personal achievement for Captain Scott, a man who, though he never admitted it, was driven by the need for personal achievements that few or none others could equal. He had gone into the torpedo service to achieve something few of his fellow officers had done; he had appeared elated in the *Discovery Expedition* photo of him, Dr Wilson, and Lt Shackleton when he knew a new latitude record was his for the taking. It showed up in his unconscious, measuring remark about the success of the first telephone in Antarctica "Not a very wonderful fact, perhaps"; in his veiled hopes about the motor sledges "but like everything else of a novel nature, it is the actual sight of them at work that is impressive, and nothing short of a hundred miles over the Barrier will carry conviction to outsiders"; his meltdown when the motor sledges failed; and finally in his heartbroken expression at the South Pole. For the first time in his life, Captain Scott had failed to reach a primary personal objective. "[G]ood-bye to most of the daydreams" indeed. Those daydreams included Captain Scott's daydream, indirectly expressed just before he left Britain, of finally leaving behind the obsolete pre-dreadnought battleships and getting a prestigious posting in an *Invincible*-class battlecruiser.[97] Thus the outcome of the expedition and in particular the prospect of priority of reaching the South Pole was the greatest concern for their future life, and in Captain Scott's case a vital vindication of his *raison d'être*.

On top of all of that, he certainly had no honors from his country to look forward to on his return in 1913. Before I explain why, I must apologize for the big mess that is

the British societal system known as the Tables of General Precedence. A sensible system would be to segregate the elements of the British social structure from each other, then internally segregate within the elements, then rank them in precedence. Instead, the Tables of General Precedence mix them all up, putting some with a rank in some Order below others with an identical rank in a different Order, and haphazardly mixing in nobility, positions, and children of both with no real pattern visible. Though this section, I will be using the Tables of General Precedence, specifically the Table of Precedence for Men, in the 1913 edition of *Debrett's*, as my guide for determining British honors' relations to each other.[98]

Contrary to the tragedy-distorted judgment of His Majesty the King that "… as if her husband had been nominated a Knight Commander of the Order of the Bath, as he would have been had he survived,"[99] and the 1931 edition of *Debrett's* tragedy-distorted assertion that "he would have been nominated a K.C.B. had he survived,"[100] Captain Scott had no hope of being made a K.C.B. (Knight Commander of the Bath). Four compelling examples give us the reasons why:

- Since Captain Scott[101] and Lt Shackleton[102] were both honored for their polar achievements with appointments to and promotions within the Royal Victorian Order, further significant polar achievement by Captain Scott would have been rewarded with promotion within the Royal Victorian Order, not starting fresh in the Order of the Bath.
- Lt Evans, for all his struggling to return to Cape Evans in the face of scurvy, and the reality-distorting force of the future tragedy influencing people to not only view his competent concluding of the expedition more favorably, but also honor him in place of Captain Scott, was only made a C.B. (Companion of the Bath),[103] eleven places of precedence below a K.C.B. Since a Commander in the Royal Navy like Commander Evans was likely eligible for nothing higher than a C.B., even this appointment was probably more for the tragedy-distorted reason of appointing him in place of Captain Scott than anything else.
- Kathleen Scott, in another indication of the influence of the tragedy of Captain Scott's and his companions' deaths, was granted the rare honor of the rank, precedence, and style of the wife of a K.C.B.,[104] effectively making her late husband a posthumous K.C.B.
- Lt Shackleton, for all his unprecedented physical effort in Antarctica, finding a way through the mountains, falling just short of the Pole before having to turn back, setting an impressive new latitude record in the process, and the par-for-the-course scientific component of his expedition, had been made a knight bachelor,[105] six places above a C.B. and five places below a K.C.B.

Captain Scott, as a person acquainted with the Tables of General Precedence from functioning in British high society and from his own promotion to a C.V.O. (Commander of the Royal Victorian Order), had to have taken note that going all out in achievement put Lt Shackleton one place above him in precedence. From Lt Shackleton's shining example, Captain Scott knew that if he made it back, with his only above par achievement being finishing the last miles to the South Pole, he would have nowhere to go in the Royal Victorian Order unless he could pull off a greater feat. After all, it would not do to promote Captain Scott or make him a knight bachelor for

scoring par for a polar expedition and following Lt Shackleton's route to do the last miles to the South Pole and back.

Thus, Karen May and George Lewis are truly ignorant when they declare that Captain Scott would have been made a K.C.B. had he survived, using Lt Shackleton's and Lt Evans' examples without context and repeating *Debrett's* without bothering to learn about precedence[106]

> For a hint of the glories that would have awaited a living Captain Scott, one need only look at the honor bestowed upon Lt Evans in 1913. Lt Evans was only the nominal head of the expedition, the title having defaulted to him after Scott's death. Lt Evans had not seen the south pole; in fact he had not even seen the expedition's second winter, having been invalided home early in 1912 with scurvy. Yet as the nearest thing to Scott himself he was made a C.B., a Companion of the Order of the Bath (London Gazette 16 May 1913: 1). In 1909 Lt Shackleton had turned back roughly 97 nautical miles from the pole, and had come home to British honor and acclaim rather than accusations of failure: he was immediately made a C.V.O., a Companion [*sic*] of the Victorian Order [*sic*] (London Gazette 16 July 1909: 5) and this was followed by a knighthood (London Gazette 24 December 1909: 1). Had Scott, already a C.V.O., returned, his would have been a higher honor than Shackleton's standard knighthood [*sic*]: Captain Scott would have been made a K.C.B., Knight Commander of the Bath. Captain Scott's widow Kathleen was given the title of 'Lady Scott' and 'granted rank, style, and precedence of the widow of a K.C.B.' Her entry in Debrett's Baronetage states that Captain Scott 'would have been nominated a K.C.B. had he survived' (Debrett's 1929: 118).

Understandably, they do not seem to understand the British honors system well. The Royal Victorian Order is not called the "Victorian Order," and it has never had the rank of Companion. This embarrassing mistake raises the question of if they even read the source they cite for this. In addition, they do not seem to understand that since Captain Scott was a C.V.O., if he had significantly surpassed Lt Shackleton's achievements and lived, Captain Scott would have been promoted to a K.C.V.O. [Knight Commander of the Royal Victorian Order]. This way, he would have had his knighthood and outranked Lt Shackleton by one place, rather than start fresh in the Order of the Bath like Commander Evans did since Commander Evans was a freshman to the British honors system. Finally, there is no such thing as a "standard knighthood," since there are just the unaffiliated knights bachelor as the lowest rank of knighthood, then the Knights/Dames Commander of the British Orders except for the Order of the Garter, then the Knights/Dames Grand Cross of the British Orders except for the Order of the Garter, then the Knights/Ladies of the Garter.

There is another issue Karen May and George Lewis do not understand. It is that while the Royal Victorian Order has never had limits on the number of members within it,[107] the Order of the Bath as of 1913 had a membership somewhere in the range of 1370–1404 members, including the special appointments which did not count towards the member limits for the various ranks.[108] Thus, getting appointed to the Order of the Bath as a K.C.B. was significantly harder than promotion within the Royal Victorian Order to a K.C.V.O.

The tragedy's power to distort judgment needs to be noticed and removed from the equation when dealing with the what-ifs of Captain Scott's survival. We have already seen the example of how Kathleen was granted rank and title that effectively made the late Captain Scott a K.C.B. when such posthumous appointment to a British Order was not ordinarily permitted. Another example is that she was granted a £100 annuity from the government in addition to her £200 naval pension.[109] Since Captain Scott had been declared killed in action, this was a direct violation of Royal Navy pension regulations, which required widows to forfeit their naval pensions if they "shall receive any Pension, Provision, or Allowance from the Government on account of her husband's service in a Naval or Military capacity; but Widows in receipt of Pensions from the Civil List are not deprived of their Naval Pensions on account thereof, and Widows who, in consequence of second marriage, may be eligible for either a Navy or Army Pension, may elect to receive that which is most advantageous to them."[110] The Admiralty declared the naval members of the decidedly unmilitary polar party had been "killed in action,"[111] thus making the above pension regulation applicable. Indeed, so colossal was the distortion that French polar explorer Dr Jean-Baptiste Charcot implicitly denied Lt Shackleton's and Captain Amundsen's credit for finding their routes that led to the South Pole, by declaring that "Captain Scott opened the way to the pole".[112]

The distortion reached a dizzying new height in 1915 when a memorial tablet of Captain Scott was being made for the city of Cardiff. J. L. Wheatley, the Town Clerk, handled the production of the tablet. When he asked Kathleen Scott whether or not Captain Scott's name should have the style prefix of "Sir," Kathleen responded with the following completely wrong statement[113]

> Captain Scott was given the posthumous [*sic*1] decoration [*sic*2] of a K.C.B. [*sic*3] I should certainly not put Sir [*sic*] R.F. Scott on the tablet, as he was never known by that title [*sic*4]. I don't know how the tablet reads but Knight Commander of the Bath was given when news of his death reached this country [*sic*5].

The following criticism needs to be made to point out Kathleen's unconsciously distorted judgment:

- [*sic*1] Posthumous appointment to or promotion within the Order of the Bath was not permitted.
- [*sic*2] A K.C.B. is a title, not a decoration.
- [*sic*3] Captain Scott never received this, and would not have received it had he survived.
- [*sic*4] The prefix "Sir" is a style, not a title.
- [*sic*5] This did not happen in reality.

The tablet was made with the erroneous K.C.B. post-nominals strapped to Captain Scott's name.[114]

Looking at Captain Scott's contemporaries only worsens the already terrible odds of him getting a K.C.B. According to the Navy List for 1908, the only person of Captain rank in the Royal Navy to have an honor higher than Captain Scott's C.V.O. was Sir Charles Langdale Ottley, K.C.M.G., M.V.O., who benefited from the achievements of being an aide-de-camp and a Secretary of the Imperial Defense

Committee.[115] Only 6 out of the 55 people of Rear-Admiral rank in the Royal Navy had any honor higher than Captain Scott's C.V.O.[116] K.C.B. recipients in particular only began appearing at the ranks of Vice-Admiral and higher.

To conclude and remove all doubt, let us look at Lt Evans, who unlike Captain Scott did eventually receive a K.C.B. He received his K.C.B. in 1935,[117] after nearly 40 years of naval service, reaching the rank of Vice Admiral, heroism during and after WWI, participation in the *Morning*'s two relief journeys during the *Discovery Expedition*, and participation in the *Terra Nova Expedition*. Captain Scott would simply have not achieved anything close to this in 1913. How could anyone think he had?

Inevitably, arriving at the South Pole second to Captain Amundsen meant to Captain Scott, as he noted in his journal on Jan. 16th, 1912 "All the day dreams must go". But not only Captain Scott's dreams. His comrades' dreams also evaporated, and they were literally deprived of their dreams. Not a glimpse of a genuine smile, triumph, or relief is noticeable on the pictures of the party taken at the South Pole. In his farewell letter to Sir James M. Barrie, Captain Scott summarized[118]

> I am not at all afraid of the end, but sad to miss many a humble pleasure which I had planned for the future [*sic*] on our long marches.

The possibility of not returning from Antarctica due to a fatal accident was real and must have occurred to everyone before venturing with the expedition. Quite possibly, the stories of deaths in Arctic were known to them, in particular, the story of Franklin's lost expedition. Thus, death due to fatal accident was a part of the expedition's atmosphere. After all, George Vince's[119] memorial cross, erected on the Hut Point promontory, constantly reminded them about that. Death due to general health problems must also have been considered.

In addition to the above, death due to altruistic suicide was considered by *Terra Nova Expedition* members and Cherry-Garrard plainly commented[120]

> Practically any man who undertakes big polar journeys must face the possibility of having to commit suicide to save his companions, and the difficulty of this must not be overrated, for it is in some ways more desirable to die than to live, if things are bad enough: we got to that stage on the Winter Journey. I remember discussing this question with Bowers, who had a scheme of doing himself in with a pickaxe if necessity arose, though how he could have accomplished it I don't know: or, as he said, there might be a crevasse and at any rate there was the medical case.

Although Lt Shackleton in 1903 was seriously incapacitated, he was dragged to safety by Captain Scott and Dr Wilson. Similarly, Lt Evans in 1912 was falling due to scurvy, but eventually was saved by Crean and Lachly. Strangely, none of that happened in Captain Scott's South Pole party.

From now on I will enumerate and argue chronological events, which in my view prove the notion that Captain Scott's party with *esprit de corps* premeditated to commit *altruistic* suicide on their homeward journey.

They might not exactly think in the general terms of altruistic suicide first described in 1897 by the father of sociology Émile Durkheim. Altruistic suicide is suicide committed by an individual or a group of individuals for the benefit of oth-

ers within the social group, enabled by bonds so strong and intense that they create a powerful sense of group identity (*esprit de corps*), with individuals being completely dependent upon the group. In Durkheim's own words[121]

> [W]hen a person kills himself … it is not because he assumes the right to do so but, on the contrary, *because it is his duty*. If he fails in this obligation, he is dishonored and also punished, usually, by religious sanctions … Now, we have seen that if such a person insists on living he loses public respect; in one case the usual funeral honors are denied, in another a life of horror [*sic*] is supposed to await him beyond the grave. The weight of society is thus brought to bear on him to lead him to destroy himself.

Self-immolation by altruistic suicide for the purpose of martyrdom has a long and complex history and many variations. In here, martyrdom is understood as readiness to sacrifice one's or group's lives for a cause or common cause in the group.[122] One should also observe a similarity of altruistic suicide with the notion of Captain Scott's utilitarianism as discussed in subsection 12.1.1.

My main thesis is that:

> Captain Scott and his party committed altruistic suicide by deciding not to return to home base at McMurdo Sound for the sake of utilitarian doctrine – the greatest happiness of the greatest number of people – and for self-immolation through the sham and pretence of submission to science, nation and nature.

The points of the above thesis are scattered throughout the previous chapters where various aspects of Captain Scott's expedition have been analyzed. In what follows, I will summarize the circumstantial evidence to support my thesis.

12.4.1. Scientific and circumstantial evidence of altruistic suicide

It is staggering to realize that while looking at Captain Scott's journey to the South Pole, all evidence before our eyes was made by Captain Scott's party in the form of diaries, pictures and their belongings. From the other side, our understanding of this journey is also supported by evidence of events before the journey started and meteorological record at Cape Evans/Hut Point. In addition to these, we are in possession of modern meteorological data of the area, scientific tools as analysis, and the ability of critical thinking.

All of these elements collectively represent circumstantial evidence of the case, and using it one can look at Captain Scott's journey and formulate educated inferences to events described by Captain Scott.

Event 1.

> From the beginning of February 1912, without any apparent reason and more importantly without Captain Scott's comment and worries, the *sustained* sledging velocity of the party was *steadily* decreasing (see Fig. 11.9B).

In order to develop my argument, let us return to Captain Scott's party sledging over the Antarctic Plateau toward the Beardmore Glacier. More particularly, let us look at Fig. 11.9 which depicts Captain Scott's party daily sledging velocities as well as – and what is more interesting and telling – the *sustained* sledging velocities. Sustained velocity is the sledging velocity at which the party was sledging despite day to day fluctuations of sledging velocity. Captain Scott's logistic plan, as I discussed at length in sections 9.3 and 9.4, required the party to sledge at a sustained velocity to reach depôts at certain intervals. From Captain Scott's journal, one observes that all along he was aware of this obvious issue. The change of logistics due to taking an extra man, Lt Bowers, to the South Pole, by itself confirms Captain Scott's command of sustained sledging velocities (see subsection 11.1.8).

From when the party approached the Beardmore Glacier until Mar. 19th, the party's sustained sledging velocity as depicted on Fig. 11.9B was *steadily* decreasing. Although Captain Scott records in his journal distances and party progress, he entirely fails to comment or observe that the party sustained sledging velocity was rapidly falling down. Friday, Feb. 2nd, 1912 marks the time (see Fig. 11.9B) from which Captain Scott's party not only systematically slowing down its sustained sledging velocity, but also it marks the beginning of many alleged troubles, which according to Captain Scott finished the party. Coincidentally, Captain Evans in his account of Captain Scott journey guessed that from February[123]

> It was probably the beginning of the end.
> February brought little to the party but bad luck and reverses. Wilson had strained a tendon in his leg. Evans's fingers were in a bad state through frostbite, and on the first of the month Scott himself had fallen and shaken himself badly. Temperatures low, too low for any good surface [*sic*]. February 4 found the party amongst crevasses, both Scott and Evans falling into them. Notwithstanding all their troubles they made a fine pace over the ice-capped plateau and down the Beardmore.

One more time the culprit is temperature. However, it is a false culprit. Not only it is not factual, but also Captain Evans after stating "too low for any good surface" contradicts himself by saying that the party had "a fine pace" over the Plateau and the Beardmore Glacier. But of course, neither of his comments is true. Captain Scott's party pace was not fine. It was at least during the Plateau stage as required by the flexible sledging plan. However, starting with the party's descent of the Beardmore Glacier, their sustained sledging velocity was systematically decreasing and no one was alarmed by this simple fact. The investigative reader should readily observe here that I am speaking about sustained sledging velocity and not daily sledging velocity fluctuations.

Event 2.

On February 6th, 1912 Captain Scott started and continued until the end of March 1912 to forge data about food and fuel shortages (see Table 9.2).

After slowing down the sustained sledging velocity on or at about Feb. 6nd, 1912 the party sledged toward the Beardmore Glacier and the Upper Glacier Depôt was reached at about 3 pm on Feb. 7th, 1912. The day before, on Feb. 6th Captain Scott

made his first fake comment about low food. Captain Scott's comments about alleged food/fuel shortages *continue* to the very end of his journal entries. However, as I presented and discussed in subsections 9.4 and 11.1.10, the party had *full* sledging rations at least until *March 27th, 1912* (see Fig. 11.16). This fact alone provides evidence that the party (Captain Scott, Dr Wilson and Lt Bowers) was not interested in sledging to One Ton Depôt and Hut Point.

Event 3.

Lt Bowers ceased keeping his diary completely at the Upper Glacier Depôt on Feb. 7th, 1912. On Jan. 30th Lt Bowers ceased regular diary entries.

Keeping diaries during the sledging journeys was important for many reasons. Essentially these diaries were an invaluable source of information for explorers themselves, as well as for posterity. The importance of the diaries' content was later acknowledged by multiple editing and changes to the printed version of Captain Scott's sledging diary, see sections 2.1, 2.2, and subsection 10.6.2. Captain Scott's journal was significantly edited on this day (Feb. 7th) when the line "They [Second Return Party – KS] have taken on their allowance of food" was deleted from the printed edition.[124] One rightly may wonder why such a seemingly plain sentence was removed. However, keeping in mind that from the day before, Event 2, Captain Scott started a long process of unfounded complaints about food/fuel shortages, may explain Huxley or/and Cherry-Garrard's intentions. The amount of food/fuel on Feb. 7th at the Upper Glacier Depôt was exactly as it should be for Captain Scott's 5-man party to sledge down the Beardmore Glacier to the Middle Glacier Depôt at 84°24′S.

It is feasible that the party decided that it would be better for the unified description of events if only one source of events was available. Therefore, the decision was taken that one by one, Lt Bowers, Captain Oates, and Dr Wilson would cease writing entries in diaries.

Captain Evans noticed[125] the abrupt change in Lt Bowers' diary after Jan. 29th

> 'January 29. – Our record march to-day. With a good breeze and improving surface we were soon in amongst the double tracks where the supporting party left us. Then we picked up the memorable camp where I transferred to the advance party. How glad I was to change over. The camp was much drifted up, and immense sastrugi … etc.'
>
> Day's marches, temperatures, and so on, then his diary commences missing days out and only contains two line entries in short, sharp notes such as: –
>
> 'January 31. – Picked up depot 11.20 a.m. Picked up my ski 6.15 p.m. No wind latterly – heavy surface. 13½ – Bill's leg – Evans's fingers – extra biscuits, etc.;'

and

> 'February 11. – Very heavy surface – ice crystals – movement of upper currents – Evans cook – finer weather – lower temperature – sastrugi. Run 11.1.'

and made his conclusion[126]

> It was probably the beginning of the end.

Event 4.

On Feb. 8th and 9th, the party geologized along Mt Buckley.

The day after Lt Bowers ceased keeping his diary, the party geologized along Mt Buckley (see Fig. 12.3 and Fig. 9.5). This particular action and its consequences

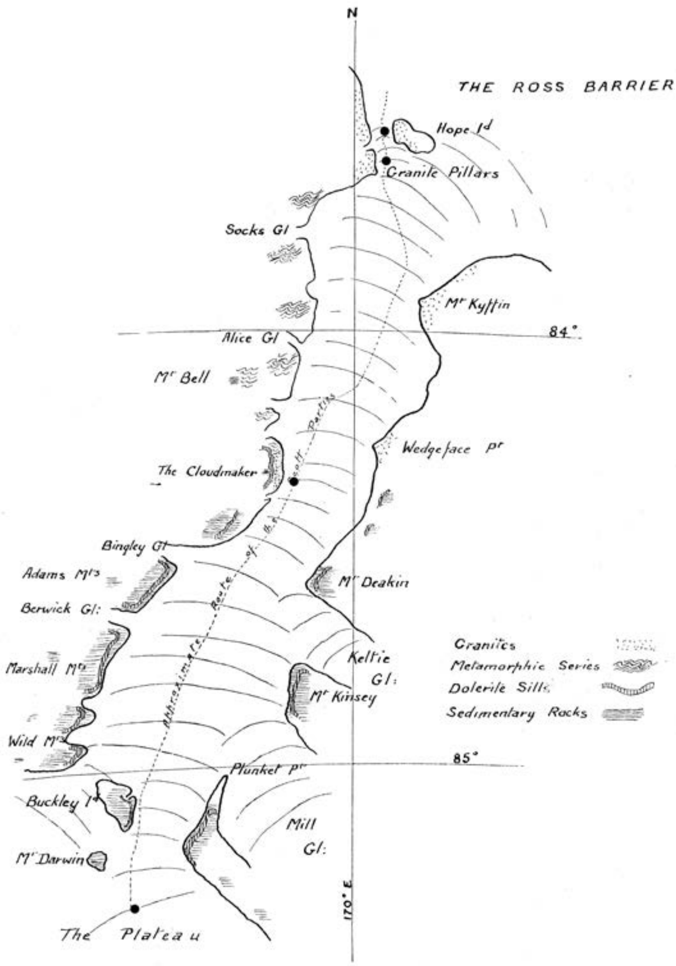


Fig. 5.—Sketch-map of the Beardmore Glacier. (Scale approximately 10 miles to the inch.)

Figure 12.3. The Beardmore Glacier and the approximate route of Captain Scott's party.[1] Approximate locations of Upper Glacier Depôt, Middle Glacier Depôt, Lower Glacier Depôt, and Shambles Camp are indicated by ●, respectively. At the head of the glacier, Mount Buckley, sometimes called Buckley Island or Buckley nunatak, is depicted. Returning parties, as well as Lt Shackleton's party in 1908, approximately, followed the route indicated.

[1] F. Debenham, *No. 4a. – The Sandstone, Etc., of the McMurdo Sound, Terra Nova Bay, and Beardmore Glacier Regions*, *British Antarctic* (*Terra Nova*) *Expedition, 1910*, Natural History Report, Geology Vol. 1, No.1, *cf.* p. 101–130; *The Sedimentary Rocks of South Victoria Land*, The Trustees of the British Museum, London, 1921, *cf.* p. 114.

received post-factum assessments at either extreme. These practically minded people could not reconcile the reasons why the party wasted time and effort to collect and drag to their very end 35 ℔ of geological specimens. The "science-terians" on the contrary, unable to prove their thesis, empty-handed prized Captain Scott and his party as "heroes who laid down their lives in the cause of science".[127] This conflict in assessment provides a clue to Captain Scott's reasons to geologize and later drag the collected specimens.

From the time when Captain Scott learned about Captain Amundsen's intentions, from the time when the presence of *Fram* in the Bay of Whales was discovered until arriving second at the Pole, the scientific tilt is readily observed (see also subsection 12.1.2) in his account of the expedition. Science, or rather its ratio in expedition activities, was Captain Scott's safety valve. After arriving second to Captain Amundsen at the Pole, not much can be done to change the outcome except turning back "with sore feelings".[128] Indeed, Captain Scott was reduced to the postman, who was being asked to deliver Captain Amundsen's letter to Norwegian King Haakon VII.

It is fair to suppose that Captain Scott was aware of Lt Shackleton's work who described the following finding[129]

> After dinner to-night Wild went up the hill-side in order to have a look at the plateau … He also brought down with him some very interesting geological specimens, some of which certainly look like coal … There are vast quantities of it lying on the hill-side. We took a photograph of the sandstone, and I wish very much that we could spare time to examine the rocks more thoroughly. We may be able to do this on the way back. We have but little time for geological work, for our way is south and time is short, but we found that the main rock is sandstone and on our way back we will collect some.

I am citing Lt Shackleton's account here not to discuss the significance of his party's finding (at Mt Darwin, see Fig. 12.3), but to point out his rational action to not waste precious time. The investigative reader could also observe that they used a camera to take a photo and expected to collect specimens on their way back. It is not clear from Lt Shackleton's account when the specimens were collected, but what is certain is that they brought back a very few samples that were sufficient for science to identify fossilized organic matter.[130] It is rhetoric to ask why Lt Shackleton's party did not collect 35 ℔ of specimens and drag it back to Hut Point and Cape Royds.

Lt Shackleton's above case was well known and widely acknowledged. However, before Captain Scott collected his 35 ℔ of specimens, the First Return party on Dec. 25th camped at Middle Glacier Depôt (see Fig. 12.3) and Charles Wright (Silas) casually noticed in his journal[131]

> Spent a few minutes [*sic*] at lunch collecting rocks from isolated moraines off Cloudmaker.

As usual Silas was laconic in his journal, however with his curiosity on July 27th, 1912 he described[132]

> Later in day Beardmore [Glacier area] limestone specimens [were] gone over & indications of several fossils found in one of my pieces. [I] found quite

> a perfect coral or Archaeocyathus – probably an Omphylum (?) perturbinate (coral). One section has a distinct centre. Took photos [with] 3" [diameter] lens, 10" [focal] length.

One more time, I am not citing Silas to discuss geological issues, but to point out his rational approach in getting entries into the scientific annals of discovery. He geologized "a few minutes" and brought back a few specimens, one of which just recently surfaced at Christie's auction house in 2010. The size of the specimen is about 5 cm (2½ in) and consists "a fossilized leaf (possibly a glossopterid [*sic*, *Glossopteris* – KS])".[133]

Thus, Sir Charles Seymour Wright, the *Terra Nova Expedition*'s glaciologist and assistant physicist was possibly the first to find *Glossopteris* from isolated moraines off Cloudmaker on Dec. 25th, 1912. To do so, he needed a "few minutes" and a 5 cm specimen. Yet again, a rhetorical question arises if one compares Wright's finding with the 35 ℔ of the Captain Scott party's specimens.

One is even more astonished if one recalls at this moment my analysis of four scenarios (see subsection 11.1.11) which Captain Scott could implement to reduce the number of specimens dragged and ensure that possible scientific impact of specimens will be ensured, since such a clear intention existed.

Nothing rational happened, and Captain Scott's party endlessly dragged 35 ℔ of useless rocks all along the Beardmore Glacier and the Barrier to their final camp. "At Wilson's special request [*sic*], they clung to the end".[134] No thought was given during the journey to the Pole by a Pole-seeking Captain Scott to having his returning parties carry out geological specimen gathering. Instead, this pile of rocks, instead of a few sheets of paper with Dr Wilson's gifted hand drawings of the most interesting samples on them, was Captain Scott's and the party's deceitful and tacit statement of submission to science and scientific progress.

Dr Taylor's account, titled *The Physiography of the McMurdo Sound and Granite Harbour Region* of his work on the *Terra Nova Expedition* is dotted with his hand drawings. Altogether, 173 hand drawings and CXLIII (153) "plates" illustrating his scientific arguments. So it was in the works of Charles Darwin, Alexander Humboldt's, and scores of other scholars. Dr Haeckel's hand drawing in Fig. 12.2 is an additional fine example that such a figure was sufficient scientific evidence. During the journey to the South Pole, Dr Wilson many times sketched in his diary various natural features. Could not he make a drawing of imprints on collected rocks? Could not they select a few of the most promising samples and simply depôt the rest at a given location for later retrieval?

Of course, Dr Wilson was more than capable of making precise and exact drawings. But there was no interest in a mere few sheets of paper, there was only a will to portray themselves as "martyr[s] of science" or "scientists to the end". A pile of rocks, dragged and kept with them even at the moment when death poured into their eyes, appeals to the reader's imagination.

Dragging 35 ℔ of rocks instead of just a few or just Dr Wilson's hand drawings of imprints in specimens only proves that the party did not have a clue what they were looking for and what they were dragging. Otherwise, they could have picked the important specimens to carry, and left the rest at a recorded place.

Finally, the investigative reader must observe that all the above critical comments about scientifically pointless specimens dragging by Captain Scott on Dr Wilson's

"special request" are supported by the *Rules of Collecting* of specimens advised and described in the *Antarctic Manual* which explicitly points out[135]

> In collecting fossils, it is useless [*sic*] to take many specimens of one kind unless carriage [*sic*] is exceptionally plentiful. Two or three good examples of each kind are usually sufficient, but as many kinds as possible should be collected.

Indeed, Lt Shackleton and Wright intentionally or unintentionally followed this simple – and the only logical – rule of specimen collecting. But Captain Scott could not collect "two or three good examples". He and his party were not interested in specimens. They dragged 35 ℔ of rocks to be "scientists to the end". That is at least as some people labeled their intentions of collecting and dragging to the end of 35 ℔ of rocks.

In here one has to recall that the Northern Party in Lt Shackleton's and Wright's spirit, and on the contrary to Captain Scott's party, while in their desperate return to Cape Evans depôted geological and other specimens at Cape Adare and Evans Cove. These items were retrieved by the *Terra Nova* in January 1913.

Event 5

On February 17th, the party almost abandoned Edgar Evans (yet not the specimens) in a false sledging rush. P. O. Edgar Evans dies on this day.

I admit that Captain Scott's description of events related to the death of P. O. Edgar Evans on my first reading was shocking and highly disturbing to me. To empower my argument, let me recite (see also the beginning of section 9.2) Captain Scott's bizarre account

> Abreast the Monument Rock [*sic*][136] we stopped, and seeing Evans a long way [*sic*] astern, I camped for lunch. There was no alarm at first [*sic*], and we prepared tea and our own meal, consuming the latter. After lunch [*sic*], and Evans still not appearing [*sic*], we looked out, to see him still afar off. By this time [*sic*] we were alarmed … I was first to reach the poor man and shocked at his appearance; he was on his knees with clothing disarranged, hands uncovered and frostbitten, and a wild look in his eyes.

True or not true, it is a disturbing and cruel account. P. O. Evans was already in bad shape, barely walking along, and Captain Scott reproachfully noted in his journal "We had to push on, and the remainder of us were forced to pull very hard, sweating heavily". Poor P. O. Evans instead of dragging the sledge "forced" the party "to pull very hard". And they pulled the sledge. On this day, Feb. 17th the party had on their sledge 1½ day food/fuel ration for 5-man (½ of ration to be consumed for remaining part of Feb. 17th). It was sufficient, and as planned, to reach on the next day the Lower Glacier Depôt as illustrated on Fig. 9.8. Thus, the party dragged roughly ¼ X.S. unit (see Table 9.3). At about this location but back in December each 4-man party was loaded with 7 X.S. units (see Fig. 9.8) and effectively sledged up the Beardmore Glacier.

Of course, one more time Captain Scott grossly exaggerated, by 28 times, to impress the readers with his party's willingness to push homeward even at the cost of abandoning fellow explorer P. O. Evans.

When I picture Captain Scott, Dr Wilson, Captain Oates, and Lt Bowers *preparing tea and lunching* abreast the Monument Rock while "the poor man" "on his knees" with "a wild look in his eyes" is pushing forward, I get shivers and an honest dislike of the party. If [*sic*] it was the case, then it shows the worst possible face of Captain Scott and his companions.

However, I think that it was not the case and that Captain Scott intentionally made it up to tell us his false determination to push homeward. The *real* willingness of pushing homeward could be expressed by Captain Scott if he readily in writing observed that his party's *sustained* sledging velocity was from the beginning of February steadily falling down, from 12.15 miles/day on Feb. 2nd to 11.06 miles/day on Feb. 18th.

Event 6

From Feb. 18th the party after passing the Shambles Camp (five) and other pony corpses (five) along the return route almost entirely ignored pony meat. Altogether ten ponies!

P. O. Evans perished on Feb. 17th, 1912. The next day the party approached the site known as Shambles Camp, where in December of the previous year five ponies were shot. The Event 6 compresses two issues significant for understanding Captain Scott's character and often contradictory way of thinking.

The first issue is related to Captain Scott and his utilitarian halo. In subsection 12.2.1, I elucidated the roots of Captain Scott's utilitarian thinking about dogs and in the broader sense about humans. I was critical about Captain Scott's usage of the utilitarian notion in an environment not suitable for its implementation like Antarctica, and particularly in planning the logistic of the South Pole journey. The utilitarian notion grew out of industrial and post-industrial British society, and at that time was hardly transferable to most of the societies around the world. That means that the utilitarian concept was not to be used in conditions different than these taking place in England between humans and animals.

What happened with the five ponies at Shambles Camp is puzzling, not because they were shot, but because their consumable meat was not significantly included in Captain Scott's food logistics. Since the hay was not transported for the ponies to use for their return, it is evident that Captain Scott from the beginning was planning to drag ponies to their deaths. That is obvious and it is equally evident that Captain Scott's utilitarian thinking oddly *did not* apply to ponies.

The second issue linked to Event 6 is exemplified by a natural question: If Captain Scott know from the beginning that the ponies at unspecified locations will be shot for various reasons, why were their cutlets not a part or supplementary part of the returning parties' menus? In this regard, Table 11.2 is indeed telling. Along the return route between Shambles Camp and One Ton Depôt and at the following dates; Feb. 17th (Bones, James Pigg, Nobby, Snatcher, and Snippets), Feb. 19th (Michael), Feb. 23rd (Victor), Feb. 23rd (Christopher), Feb. 26th (Chinaman) and Mar. 3rd (Jehu),

the mentioned pony cutlets *were available* to all returning parties, *including* Captain Scott's party.

On Fig. 12.4, along with the original depôts, I depicted approximate pony cutlet locations. At these depôts and cutlet locations, Captain Scott's returning party could re-supply its rations. Additionally after P. O. Evans' death at the foot of the Beardmore Glacier on Feb. 17th and after Captain Oates' altruistic suicide on Mar. 17th their unconsumed rations were readily available to the party (see also Fig. 11.16 and Tab. 9.2).

Confronting the above observations alongside Captain Scott's journal entries from the time when the party reached the Barrier, one inevitably gets confused about his comments of continuous hunger and lack of food/fuel. Indeed, the party had *full*

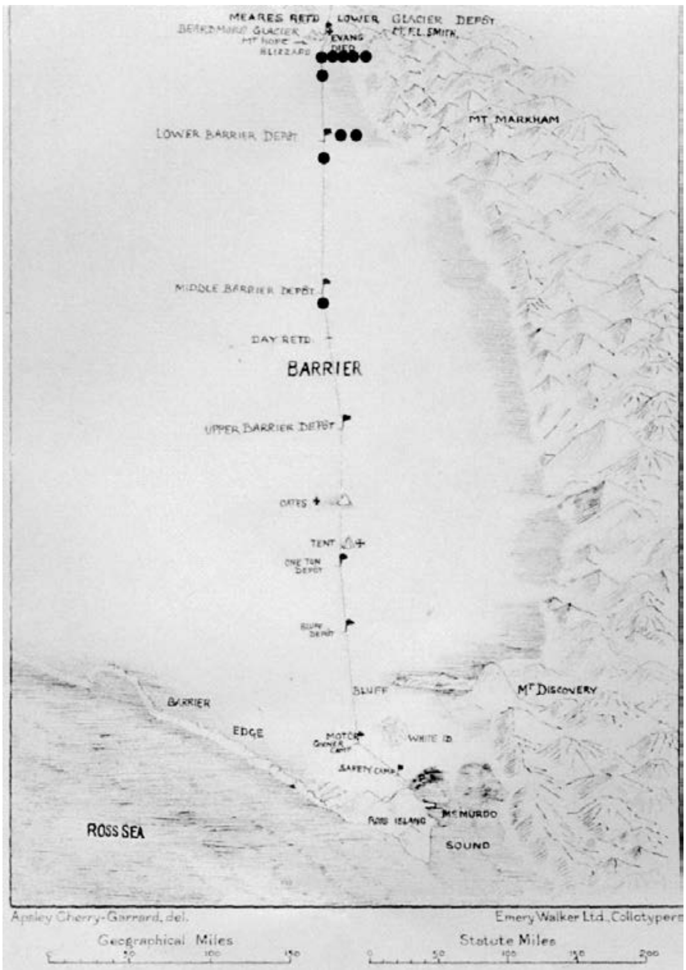


Figure 12.4. Captain Scott's route along the Barrier with depôts and approximate locations of pony cutlets indicated by ● per pony.

food/fuel rations at least until Mar. 27th (see also subsection 11.1.10), and additional pony cutlets available along the return route on the Barrier.

In here, it would be too tedious to comment on each of Captain Scott's food/fuel related entries after Feb. 17th. Let me just point out Captain Scott's self-conflicting comments at the end of his journal. During the final days Captain Scott writes[137]

> [Mar. 19th] We are 15½ miles from the depôt and ought to get there in three days. What progress! We have two days' food but barely a day's fuel.
>
> [Mar. 22nd and 23rd] … unable to start-to-morrow last chance – no fuel and only one or two of food left – must be near the end.
>
> [Mar. 29th] We had fuel to make two cups of tea apiece and bare food for two days on the 20th.

Evidently these accounts are self-contradictory. The party of four arrived at camp 52, the Upper Barrier Depôt (Mount Hooper), on Mar. 9th. The depôt was the last one before the party would reach the One Ton Depôt at the distance 64.15 miles and contained $1^1/_4$ X.S. sledging unit. That is well over 8 daily food/fuel rations for 4 men.

Nothing, literally nothing adds up if one follows Captain Scott's journal entries. Captain Scott wanted us to believe that his party was sledging on low food/fuel and thus unable to reach One Ton Depôt. Captain Scott's account on Mar. 19th that the party had "two days' food" is simply incorrect. Instead, the party had almost seven days of food rations (see Figs. 11.16 and 11.18) and about the same fuel rations (see subsection 11.1.9 for fuel related discussion).

Well before Captain Scott was on the Barrier and return legs, the question of pony meat was raised when expedition glaciologist and assistant physicist Charles Wright, nicknamed Silas, in relation to Captain Scott's lecture outlining "summer organisation" commented many years later [138]

> I get some satisfaction to reflect that I had believed that Scott's plans as outlined seemed to give little thought to this additional source of food [pony meat] and that I had asked Dr. Bill to raise this matter with Captain Scott. I do not know if he did, but I heard no more and feel bound to say that I was in no position to suggest what items might be dropped to make up for the extra oil required for cooking it.

Indeed, Captain Scott did not plan that the ponies would return to Hut Point from the Barrier. His thinking about dogs did not extend to ponies and they were unscrupulously taken to their deaths. The ponies' return meant that they would have required pallets of hay to feed them during the return. That meant that Captain Scott would not have sufficient rations to sledge to the Pole. And that is the reason why the ponies were deprived of the dog's rights.

Silas, years later, while writing the introduction to the published version of Dr Wilson's diary repeated his concerns[139]

> One case which I remember so clearly, because I felt very strongly about it, was the apparent neglect in Scott's plan to make the maximum use of the meat of the ponies, the survivors of which were to be shot at the foot of the Beardmore Glacier on the way to the South Pole. I spoke earnestly to Dr.

> Bill [Dr Wilson] that the use of this meat should be part of the plan even though it would mean giving up something else to make room for the extra fuel needed to cook the meat. Even Atkinson's party returning from the top of the Beardmore Glacier would have been very glad of additional food. I, for one, was very hungry by then.

Silas' suggestion could not for whatever reason (and the reason was not given to Silas) fit into Captain Scott's original logistics. However, his suggestion easily fits into the *actual logistics* of Captain Scott's party returning from the Pole. The next day after P. O. Evans' death, Feb. 18th, the returning party approached the Shambles Camp, where cutlets of five ponies (see Fig. 12.4) were available. Not only were these cutlets available on Feb. 18th *but also* [*sic*], food/fuel ration allocated but not consumed by P. O. Evans. On the next day, *two* food/fuel rations not consumed by P. O. Evans were ready to be used including fuel to cook cutlets. On Feb. 20th three food/fuel rations, on Feb. 21th four food/fuel rations, *etc*.

Are we missing something here? – the investigative reader may ask. Indeed, we do not fail to notice the lack of presence of P. O. Evans' rations in Captain Scott's journal and Dr Wilson's journal. *As though these rations did not exist*. One, *if* Captain Scott was rational, truthful and trustworthy, would expect a comment like: We could not use P. O. Evans' fuel to cook cutlets. Nothing along this line can be spotted in Captain Scott's journal. He deliberately withheld this issue from his account. But not only in the case of P. O. Evans. Exactly the same happened with Captain Oates' rations.

An intriguing question arises: did the party need extra fuel to cook pony cutlets sufficiently? The answer to this simple question can be readily found in Cherry-Garrard's account[140]

> I note [in diary] "we are doing well on pony meat and go to bed very content." Notwithstanding the fact that we could not do more than heat the meat by throwing [*sic*] it into the pemmican we found it sweet and good, though tough. The manhauling party consisted of Lieut. Evans and Lashly who had lost their motors, and Atkinson and Wright who had lost their ponies. They were really quite hungry by now, and most of us pretty well looked forward to our meals and kept a biscuit to eat in our bags if we could. The pony meat therefore came as a relief. I think we ought to have depôted more of it on the cairns. As it was, what we did not eat was given to the dogs. With some tins of extra oil [*sic*] and a depôted pony the Polar Party would probably have got home in safety.

In Cherry-Garrard's fancy, extra oil could have come from *additional* fuel tins depôted at pony meat cairns. However, these Cherry-Garrard-invented fuel tins in addition to the ones carried by parties as regular food/fuel rations were not planned to be carried and depôted, and thus the Polar Party could not use them to get "home in safety".

However, the deaths of P. O. Evans and Captain Oates were not planned, and the originally allocated to them food/fuel rations were not consumed. P. O. Evans and Captain Oates perished on the contrary to plan, and their rations *enabled* the party to sledge homeward with full food/fuel rations, plus could be supplemented

by cutlets cooked with newly [*sic*] available extra fuel! Furthermore, as Cherry-Garrard stated in the above quote, the cutlets could have been sufficiently heated by putting them into the pemmican. This would have achieved a more fuel-efficient heating of food. Evidently, the party after P. O. Evans' death and well before (see section 12.4 *Denouement – I Have a Tale* to *Tell*) was not planning and willing to return home.

Event 7

On Feb. 27th, Dr Wilson ceased keeping his diary.

Just three days after Captain Oates pointlessly ceased his diary, Dr Wilson followed with the same action in the advent of Captain Scott's greatest fabrications of *Extreme Cold Snap* (Feb. 27th through Mar. 19th) and *Super Extreme Cold Snap* (Feb. 27th through Mar. 27th). Dr Wilson's journal, with his insight, could be a scientifically interesting source of information:

1. If Dr Wilson copied to it the most interesting imprints of fossils as I discussed in Event 4,
2. If Dr Wilson described the party's medical – both physical and physiological – state and it changes in due of course.

Dr Wilson's diary is about nothing of what it might be – a source of knowledge about the medical condition of the party. He as a physician could give us insight into P. O. Evans' sickness, and scurvy development between party members (see subsection 11.1.12). Instead, he chooses, like Dr Atkinson in his post-mortem report, to say nothing that might be scientifically interesting. However, Dr Wilson was not continuing to write entries in his journal. I think that he simply followed Lt Bowers' and the party's wish to speak through and with one voice, Captain Scott's journal. That ensured that their story, however entangled, would be coherent in its narrative and thus impossible to dismantle to figure out the party's plot.

Event 8

Feb. 27th through Mar. 27th, 1912 – Extreme and Super Extreme Cold Snap.

Blaming the weather for not returning from the South Pole journey was, as it appeared to Captain Scott and the party, the most effective and hard to refute single culprit. Long before, right at the onset of Four Days' Gale (see subsection 11.1.6) at the foot of the Beardmore Glacier on Dec. 5th, 1911, Captain Scott in his mind found the comforting "right" answers to all underlying issues

> Is there some widespread atmospheric disturbance which will be felt everywhere in this region as a bad season, or are we merely the victims of exceptional local conditions? If the latter, there is food for thought in picturing our small party struggling against adversity in one place whilst others go smilingly forward in the sunshine. How great may be the element of luck! No foresight – no procedure – could have prepared us for this state of affairs.

> Had we been ten times as experienced or certain of our aim we should not have expected such rebuffs.

Two days later when "the Gale" was still raging Captain Scott continued

> I can find no sign of an end [to the Gale – KS], and all of us agree that it is utterly impossible to move. Resignation to misfortune is the only attitude, but not an easy one to adopt. It seems undeserved where plans were well laid and so nearly crowned with a first success. I cannot see that any plan would be altered if it were to do again, the margin for bad weather was ample according to all experience, and this stormy December [originally "storm in December" and overlooked by Dr Max Jones – KS] – our finest month – is a thing that the most cautious organiser might not have been prepared to encounter.

In short, according to Captain Scott, his party in December 1911 was hit by bad luck and no foresight could prepare them for this state of affairs. Their margin for the bad weather was ample, and even the most cautious organizer could not be prepared to encounter it.

Captain Scott's fallacious line of reasoning in December 1911 foreshadows the method of thinking which would be adopted by the party on their way back from the South Pole.

Provided comments presented in subsection 11.1.6, I am not saying here that the Gale at 80°S (Four Days' Gale) did not happen. I am pointing out here the fallacious intellectual construct which was used in December 1911 to deal with a real weather event and later was used in February/March 1912 to describe imaginary weather events, *Extreme Cold Snap* and *Super Extreme Cold Snap*.

To emphasize the similarities between Captain Scott's thinking about the Gale at 80°S (real event) and *Extreme Cold Snap* and *Super Extreme Cold Snap* (imaginary events), let me simultaneously cite parts of his accounts of these events

> [Gale at 80°S account written on Dec. 5th, 1911]
> No foresight – no procedure – could have prepared us for this state of affairs. Had we been ten times as experienced or certain of our aim we should not have expected such rebuffs
>
> [*Message to the Public* written in late March 1912]
> But all the facts above enumerated were as nothing to the surprise which awaited us on the Barrier. I maintain that our arrangements for returning were quite adequate, and that no one in the world would have expected the temperatures and surfaces which we encountered at this time of the year.

Indeed, Captain Scott may get away with his fabrication of the *Extreme Cold Snap* and *Super Extreme Cold Snap*, and his observation that "there is food for thought in picturing our small party struggling against adversity in one place whilst others go smilingly forward in the sunshine" may hold. But only one piece of evidence escaped Captain Scott's attention. This is the evidence that the weather events, especially these of considerable and great magnitude, *are not local in nature*.

Without a doubt, it happened a great many times that an imaginary party in proximity to One Ton Depôt struggled "against adversity," and another imaginary party enjoyed a weather privilege in proximity to Hut Point or Cape Evans.

However, it never happened and it cannot happen that the described by Captain Scott *Extreme Cold Snap* and *Super Extreme Cold Snap* could take place only at the proximity of One Ton Depôt and not show its fingerprint at Hut Point (Cape Evans).

In Chapter 7, I provided scientific evidence that the described by Captain Scott *Extreme Cold Snap* and *Super Extreme Cold Snap* did not take place, and that they were invented to dramatize and conceal the Captain Scott party's committing utilitarian (altruistic) suicide by willingly not returning from the South Pole journey.

Event 9

On Feb. 24th, Captain Oates ceased keeping his diary. On Mar. 16th Captain Oates committed suicide.

Indeed, Captain Oates remains the most enigmatic officer of the *Terra Nova Expedition*. Educated, sturdy, critical yet withdrawn man – "a very gallant gentleman". That is what we use to think to glorify Captain Oates. However, even Captain Oates had his darker side, and apparently fathered a child with a very young girl of 12.[141]

On Mar. 2nd Captain Oates disclosed to Captain Scott the poor state of his feet and toes. Since Captain Oates ceased keeping his diary on Feb. 24th, 1912, from that time on we can only rely on Captain Scott's dubious record. Provided the above findings, as well as *Event 1* through *Event 8* and *Event 10* below, one must read Captain Scott's journal entries in February and March 1912 with great caution and justified criticism.

Let me ask again a devastating question: is Captain Scott's description of Captain Oates' last days trustworthy? Of course, for the reason of Captain Scott's many fabrications as presented in this book, *Events 1* through *10*, the answer must be negative. Captain Scott's narrative does not hold up when confronted with weather data analysis and food/fuel rations available to the party.

The only thing that is certain about Captain Oates' last weeks is that he perished in the Barrier in March 1912. The rest of our knowledge results from Captain Scott's description, in which we already have little trust.

Following Captain Scott's description (the only source of information), many authors presumed that Captain Oates on Mar. 16th committed an act of self-sacrifice. Roland Huntford even deduced that on or about Mar. 10th[142]

> He sat [Oates] there in the tent, Scott staring at him, with the unspoken expectation of the supreme sacrifice.

On Mar. 10th in the middle of the fabricated *Extreme Cold Snap*, Captain Scott hypocritically observed

> Oates' foot worse. He has rare pluck and must know that he can never get through. He asked Wilson if he had a chance this morning, and of course Bill had to say he didn't know [*sic*][143]. In point of fact he has none. Apart from him, if he went under now, I doubt whether we could get through. With great care we might have a dog's chance, but no more. The weather conditions are awful, and our gear gets steadily more-icy and difficult to manage. At the same time of course poor Titus is the greatest handicap [*sic*].

> He keeps us waiting in the morning until we have partly lost the warming effect of our good breakfast, when the only wise policy is to be up and away at once; again at lunch.

Yet again, like in the case of P. O. Evans' final hours, the *Event 5* above, Captain Scott is in a rush to sledge homeward and only poor Titus keeps them waiting. Later (see subsection 11.1.13), Captain Scott hypocritically observed that "we could have come through had we neglected the sick". It meant that if Captain Scott abandoned P. O. Evans and later Captain Oates, his party "could have come through".

The investigative reader must wonder about the Captain Scott's above account. What is the meaning of

> He [Oates – KS] keeps us waiting in the morning until we have partly lost the warming effect of our good breakfast, when the only wise policy is to be up and away at once; again at lunch.

Actually it is a meaningless smokescreen by Captain Scott. Indeed, in high-performance sports, one has to warm up before start to keep their performance from the start at a required level, and prevent injury. However, long distance man hauling does not officially belong to high-performance sports, and one can presume that after a few hundred yards the party will be quite sufficiently warmed up, *if* daily sledging distance in anyway dependent on initial party warmness.

Even assuming that Captain Scott was accurate with his description of events in March 1912, one hardly can read that Captain Oates committed an act of self-sacrifice on Mar. 16th. According to Captain Scott's evidence, to which I do not subscribe, the party on this day was already doomed and well beyond redemption: a shortage of food/fuel and Captain Scott's vulnerability to potential frost-bites. Therefore, within Captain Scott's picture, it is more reasonable to say that Captain Oates just committed suicide to end his suffering due to scurvy-related symptoms.

However, if one thinks in terms of the findings presented in this book, then indeed Captain Oates' action may be read as an act of self-sacrifice, provided the ridiculous notion that he was not aware of Captain Scott's super-imposed tacit plan of altruistic suicide. The same conclusion is also reached if Captain Oates was aware of this plan. Either way, Captain Oates' action is classified; but one must bear in mind, how it was used by Captain Scott's party to justify their own actions. Lt Bowers in a farewell letter to his mother echoed Captain Scott's *Message to the Public* account[144]

> … our sick companions have delayed us till late in the season which has made us very short of fuel and we are now out of food as well.

In here, Lt Bowers, the logistic man of the expedition, a man who was able to precisely rearrange food/fuel rations on the Antarctic Plateau (see subsection 11.1.8) to take the Fifth Man (himself) to the South Pole, simply tells his own mother and us a lie, hoping that we are not skilled in elementary math.

Actually, if one may say so, their "sick companions" P. O. Evans and Captain Oates by not consuming food/fuel rations, helped Captain Scott's party to stay alive on full food/fuel rations at least until Mar. 27th (see also subsection 11.1.10).

What a contradiction the investigative reader may see here. Captain Scott and Lt Bowers prize their comradeship with P. O. Evans and Captain Oates, but entirely

fail to remember that both of them left their food/fuel rations for the remaining party members. These unused (left over) food/fuel rations were actual salvation for Captain Scott's party.

Event 10

Mar. 21st through 29th, 1912 – Never Ending Gale.

Apparently, Captain Scott had a big "disaster box" from which he was from time to time pulling out different reasons to justify his party's inability to sledge homeward. But, as we have seen through various analyses, Captain Scott was desperately presenting a long list of tampered or simply fabricated "reasons for disaster". The last, *Event 10*, appear to come as a final blow to the party after all elements from the "disaster box" were already used. Interestingly in his last journal entry Captain Scott after of not writing in it for almost a week suddenly drops a bombshell

> *Thursday, March 29*. Since the 21st we have had a continuous gale from W.S.W and S.W. We had fuel to make two cups of tea apiece and bare food for two days on the 20th [*sic*]. Every day we have been ready to start for our depôt 11 miles away, but outside the door of the tent it remains a scene of whirling drift.

Certainly the Barrier is a windy place, but what to make of a wind blowing gale force for 8/9 days only at 80°S and not detectable at 77°54′S, the Corner Camp (see Chapter 8)? Of course, it is a fabrication by Captain Scott.

While reading Captain Scott's journal, one wonders why his entry on Mar. 22nd/23rd is not the last one. One even further wonders how is this possible that entirely worn out, with at least one foot frost bitten, Captain Scott lasted for eight long days on "two cups of tea apiece and bare food for two days on the 20th".

The answer is indeed simple if one recalls Fig. 11.15 and subsection 11.1.10. Captain Scott's party had complete food/fuel rations until at least Mar. 27th, 1912. It appears in the last moments of his life, Captain Scott panicked and/or got confused with his own plot of altruistic suicide and *a fortiori* felt obliged to add the last straw to the tragedy by inventing the *Never Ending Gale*. He possibly also falsified the date of his last dated diary entry, given that it is strange that he would wait several days between diary entries, and given that he would have wanted to prolong his death for drama purposes.

Thus, Captain Scott in various degrees and forms invented a plethora of events which allegedly stopped his party from reaching the One Ton Depôt and Hut Point.

Originally when I obtained the results of the artificial neural network simulations of near surface temperatures – Feb. 27th through Mar. 27th, 1912 – *Super Extreme Cold Snap*, Chapter 7 – some small doubts in its interpretation persisted and I commented in one of my original publication[145]

> while arguing deliberate distortion of temperature data by Captain Scott's Main Polar Party I actually speak here about the truth in a metalogical sense of the *de dicto* sentence about the truth of probability, and not about truth in *de re* sense.

However, after further investigation and disclosure of additional data forging events as summarized above, and described in detail in previous chapters, I conclude that the presented evidence is substantial and sufficient to conclude that Captain Scott and his party committed altruistic suicide by deciding to not return to home base at Hut Point/Cape Evans for the sake of utilitarian doctrine – the greatest happiness of the greatest number of people – and for self-immolation through the sham and pretence of submission to science, nation and nature.

12.4.2. Was Captain Scott a Scientist?

Throughout this book in a good number of occasions, I had argued that Captain Scott was RN officer with a keen interest in science, though unscientific in mind. However, *the Terra Nova Expedition*'s tilt toward science developed due to pressures resulting from the need to accommodate expedition sponsor's requests of including science and not only adventure in his exploits. Indeed, a personal distance between himself and the science can be discerned in the isolating words "these scientific people" he spoke in an interview in 1910: "I am hopeful of doing work there. I don't want to break up all these scientific people we have got together if they are working."[146] Since the notion of being a scientist is understood as a person who is trained in a branch of science, and whose job involves doing scientific research or solving scientific problems,[147] it is evident that Captain Scott and Dr Wilson, who was trained as a physician, were not scientists *per se*.

The term *scientist* is a relatively new word and appeared in the nineteenth century. In the late nineteenth and early twentieth centuries, the term *natural philosophers* was used to describe people who today are called scientists. Either way, the definition remained the same and the 1895 edition of the Webster's International Dictionary of the English Language gives "One learned in science; a scientific investigator; one devoted to scientific study".

If the scientist is the one as described above and understood by most people, then why is Captain Scott – who was not trained in or practicing science – especially recently called (portrayed as) a scientist?

In section 4.4 titled *Biased Perception of Captain Scott as a Scientist*, Dr Solomon's false statements were critically reviewed. It was pointed out that Dr Solomon's statements like for example "Scott the scientist" or "the scientific pursuits that fascinated Wilson and Scott" were empty-handed and unjustified. However, Dr Solomon had a good reason to produce these counterfactuals by appealing to science and the scientificness of Captain Scott. Yet again she produced an aesthetic fallacy by imposing the scientificness of Captain Scott on the readers[148]

> It is the reader who is duped by the form of what she [he] reads into assuming the arguments presented are much stronger than they really are.

Among all human activities, science has a particularly interesting place. Science builds and organizes in a systematic way knowledge about the Universe. The knowledge must be *testable* and must be able to give *testable* predictions. The criterion of falsifiability plays a central role in science and its theories. In here, following Dr Popper, by falsifiability I understand that if a scientific thesis is false, then it is certain that

by making the required experiment or observation (*Experimentum Crucis*), at least in principle, one can find that the thesis is false.

Obviously, the process of falsifiability can be done by anyone, anywhere and anytime and provided a fair process of falsifiability, one must conclude that science is, at least in principle, human independent. The laws of nature are *immutable*.

Many people falsely equate the notion of science with a scientist's behavior. Indeed, science through its successive iterations strives to find a true description of the Universe. But this has nothing to do with the assumption that scientists are truth tellers, and have special characteristics making them trusted and especially valuable members of societies. Good virtues and bad shortcomings are present within scientific communities, like in the general population. Therefore, one should not equate objective and truthful science with objective and truthful scientists[149]

> Scientist are not morally superior to other citizens. They have ambitions, realties, and the same set of low desires that characterizes the rest of us. However, as an institution has figured out to make these aspects of character irrelevant, so that scientific *ethos* is constituted by honest consideration of evidence and the other required virtues instead of the personal predeclinations of individual scientist.

This is the core of Dr Solomon's aesthetic fallacy, to tacitly impose on the readers of her book that Captain Scott was "Scott the scientist" or "the scientific pursuits that fascinated Wilson and Scott". Due to the aesthetic fallacy, the readers were confused and assumed that Captain Scott was in some way a scientist. However, he was not. At most, Captain Scott was the *Terra Nova Expedition* science administrator, or in modern terms a science manager. Like for example U. S. Army Corps Major General Leslie Groves, the director of the research and development project called the *Manhattan Project*. Or, to commit blasphemy, like Captain Amundsen. Scholars who recognize his science managing work have only recently begun to fight back against the popular misconception of him as not caring about science, though they have room to improve their definition of a scientist.[150] I am waiting for Professor Dowdeswell to give Captain Amundsen the same praise that he gave to Captain Scott in section 12.3.

The biggest and most dangerous offence against science, scientific progress, and the scientific community is scientific misconduct by scientists. There is no specific universal definition of scientific misconduct, but there is still plenty of agreement. For example, the *Massachusetts Institute of Technology's (*MIT) internal policy tells us that[151]

> Academic misconduct can take many forms, including fabrication or falsification of data, theft of ideas or direct plagiarism, and deliberate interference with the integrity of the work of others. Whatever the form, academic misconduct is behavior that may lead to a variety of disciplinary actions, including, in severe cases, expulsion of a student, dismissal of an employee, or termination of tenure.

Even if arguing that Captain Scott was only a science manager, or to go to the degree to assume that he was indeed a scientist, one in light of his data fabrications cannot defend these hypothetical notions. I described in length Captain Scott's making up weather data (Chapters 7 and 8), food/fuel rations shortages (Chapter 9), and *etc*. While looking at Captain Scott's *Message to the Public* which must be understood as a summary

expedition report, I pointed out these instances where he mislead and/or lied to the public (see Appendix to the Chapter 12 and subsection 12.2.1). All of Captain Scott's fabrications "strike at the heart of the values on which science is based".[152]

Based on the enumerated unscientific actions by Captain Scott, one may rightly conclude that in no way he could be called a scientist and/or related to science and scientific progress. At no instance could a genuine scientist forge say meteorological data for his personal purpose, like getting a promotion or to camouflage his and his party's decision to commit suicide. Dragging these 35 ℔s of rocks was indeed a pathetic exercise, but not dragging them to Hut Point/Cape Evans and ensuring that these rocks will end up at home base for further scientific scrutiny was unscientific. Captain Scott *was not* a scientist.

12.5. Synopsis

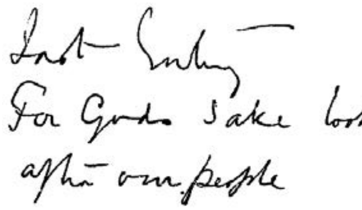
By no means was the *Terra Nova Expedition* a materially and psychologically straightforward undertaking. It appears that psychology, the human factor, prevailed in the outcome of the expedition. Not surprising, indeed. Upon arriving at the Pole and in the following days, the fact of being second to Captain Amundsen at the Pole slowly crept into Captain Scott and his comrade's consciousness. The fact of losing the priority at the Pole was a great psychological anti-climax beckoned by Captain Amundsen's ominous black flag, as if in the theatre of horror.

From the very planning stages, Captain Scott's *Deus ex Machina* was a double game (science vs. adventure) in describing the main goals of the *Terra Nova Expedition*. By shifting the accents, Captain Scott was telling stories to two different audiences interested in adventure or promotion of research in Antarctica. This latter story was effectively picked by many during the centennial of the *Terra Nova Expedition*. Unfortunately, but unsurprisingly considering Captain Scott's double game, all these attempts to present Captain Scott as a scientist went short on actual research of the subject, and only empty-handed claims were produced and sold to the public. It was done with disregard to the public and investigative readers who, being away from the tube, could not say otherwise. Captain Scott was not a scientist, as he chose his own interest over science and over reporting true meteorological data on the Barrier. His personal fears were covered by fabrications of meteorological and food/fuel data.

It is not clear how the whole notion of altruistic suicide was developed within Captain Scott's mind and party, but it is certain and supported by numerous events forming solid scientific and circumstantial evidence, that the party premeditated and committed altruistic suicide. From the time of reaching and descending from the Beardmore Glacier, the party's sustained sledging velocity was systematically falling down. The party devised an elaborate scheme of following events to convince the readers of their story that the party suffered a chain of beyond control events which led to the party's deaths. However, events described by Captain Scott, in particular the *Extreme Cold Snap* and *Super Extreme Cold Snap*, *Never Ending Gale*, and food/fuel shortages did not happen and were invented by Captain Scott. Captain Scott's plot was nearly perfect, as blaming immeasurable weather conditions seemed a perfect culprit of disaster. However, with the help of science and scientific methods, it was possible to find the relationship between Cape Evans and the Barrier temperatures,

which proved that Captain Scott's temperature record was a fabrication. This, supported by other gestures and actions (events) helped to convince the readers to who he told his "entire" story, to the moment when "It seems a pity, but I do not think I can write more". Captain Scott told his story and indeed admitted a supreme failure. But it was not a failure due to "faulty organization" or failure due to what has been "worked out to perfection". It was "awful weather and unexpected cold towards the end of the journey" which "has thrown out my calculations".

Captain Scott and his party committed altruistic suicide by deciding to not return to home base at McMurdo Sound for the sake of utilitarian doctrine – the greatest happiness of the greatest number of people – and for self-immolation through the sham and pretence of submission to science, nation and nature.


Last entry
For Gods Sake look
after our people

> "Last entry.
> For God's sake look after our people"
>
> … Because man dear *we can do without you* please know for sure we can. God knows I love you more than I thought could be possible, but I want you to realise that it won't [crossed out] wouldn't be your physical life [*sic*] that would profit me and Doodles [their son Peter] most. If there's anything you think worth doing at the cost of your life – Do it [*sic*]. We shall only be glad. Do you understand me? How awful if you don't.
>
> Kathleen Scott's letter to Captain Scott[153]

12.6. Appendix to Chapter 12 and Subsection 12.2.1.

This Appendix illustrates what happens to Captain Scott famed *Message to the Public* if one removes from it the parts which were unsubstantiated and/or simply fabricated. First I present the complete and original text of the *Message to the Public*. Then I present the same text but with parts deleted for mentioned reasons.

MESSAGE TO THE PUBLIC

The causes of the disaster are not due to faulty organisation, but to misfortune in all risks which had to be undertaken.

1. The loss of pony transport in March 1911 obliged me to start later than I had intended, and obliged the limits of stuff transported to be narrowed.
2. The weather throughout the outward journey, and especially the long gale in 83°S., stopped us.
3. The soft snow in lower reaches of glacier again reduced pace.

We fought these untoward events with a will and conquered, but it cut into our provision reserve. Every detail of our food supplies, clothing and depots made on the interior ice-sheet and over that long stretch of 700 miles to the Pole and back, worked out to perfection. The advance party would have returned to the glacier in fine form and with surplus of food, but for the astonishing failure of the man whom we had least expected to fail. Edgar Evans was thought the strongest man of the party.

The Beardmore Glacier is not difficult in fine weather, but on our return we did not get a single completely fine day; this with a sick companion enormously increased our anxieties. As I have said elsewhere we got into frightfully rough ice and Edgar Evans received a concussion of the brain he died a natural death, but left us a shaken party with the season unduly advanced.

But all the facts above enumerated were as nothing to the surprise which awaited us on the Barrier. I maintain that our arrangements for returning were quite adequate, and that no one in the world would have expected the temperatures and surfaces which we encountered at this time of the year. On the summit in lat. 85° 86° we had – 20°, – 30°. On the Barrier in lat. 82°, 10,000 feet lower, we had –30° in the day, –47° at night pretty regularly, with continuous head wind during our day marches. It is clear that these circumstances come on very suddenly, and our wreck is certainly due to this sudden advent of severe weather, which does not seem to have any satisfactory cause. I do not think human beings ever came through such a month as we have come through, and we should have got through in spite of the weather but for the sickening of a second companion, Captain Oates, and a shortage of fuel in our depots for which I cannot account, and finally, but for the storm which has fallen on us within 11 miles of the depot at which we hoped to secure our final supplies. Surely misfortune could scarcely have exceeded this last blow. We arrived within 11 miles of our old One Ton Camp with fuel for one last meal and food for two days. For four days we have been unable to leave the tent the gale howling about us. We are weak, writing is difficult, but for my own sake I do not regret this journey, which has shown that Englishmen can endure hardships, help one another, and meet death with as great a fortitude as ever in the past. We took risks, we knew we took them; things have come out against us, and therefore we have no cause for complaint, but bow to the will of Providence, determined still to do our best to the last. But if we have been willing to give our lives to this enterprise, which is for the honour of our country, I appeal to our countrymen to see that those who depend on us are properly cared for.

Had we lived, I should have had a tale to tell of the hardihood, endurance, and courage of my companions which would have stirred the heart of every Englishman. These rough notes and our dead bodies must tell the tale, but surely, surely, a great rich country like ours will see that those who are dependent on us are properly provided for.

(Signed) R. Scott

What follows is Captain Scott's *Message to the Public* with the highlighted parts accounting for the events which were fabricated or did not take place.

MESSAGE TO THE PUBLIC

The causes of the disaster are not due to faulty organisation, but to misfortune in all risks which had to be undertaken.

1. The loss of pony transport in March 1911 obliged me to start later than I had intended, and obliged the limits of stuff transported to be narrowed.
2. The weather throughout the outward journey, and especially the long gale in 83°S., stopped us.
3. The soft snow in lower reaches of glacier again reduced pace.

We fought these untoward events with a will and conquered, but it cut into our provision reserve. Every detail of our food supplies, clothing and depots made on the interior ice-sheet and over that long stretch of 700 miles to the Pole and back, worked out to perfection. The advance party would have returned to the glacier in fine form and with surplus of food, but for the astonishing failure of the man whom we had least expected to fail. Edgar Evans was thought the strongest man of the party.[154]

The Beardmore Glacier is not difficult in fine weather, but on our return we did not get a single completely fine day; this with a sick companion enormously increased our anxieties. As I have said elsewhere we got into frightfully rough ice and Edgar Evans received a concussion of the brain he died a natural death, but left us a shaken party with the season unduly advanced.

But all the facts above enumerated were as nothing to the surprise which awaited us on the Barrier. I maintain that our arrangements for returning were quite adequate, and that no one in the world would have expected the temperatures and surfaces which we encountered at this time of the year. On the summit in lat. 85° 86° we had – 20°, – 30°. On the Barrier in lat. 82°, 10,000 feet lower, we had –30° in the day, –47° at night pretty regularly, with continuous head wind during our day marches. It is clear that these circumstances come on very suddenly, and our wreck is certainly due to this sudden advent of severe weather, which does not seem to have any satisfactory cause. I do not think human beings ever came through such a month as we have come through, and we should have got through in spite of the weather but for the sickening of a second companion, Captain Oates, and a shortage of fuel in our depots for which I cannot account, and finally, but for the storm which has fallen on us within 11 miles of the depot at which we hoped to secure our final supplies. Surely misfortune could scarcely have exceeded this last blow. We arrived within 11 miles of our old One Ton Camp with fuel for one last meal and food for two days. For four days we have been unable to leave the tent the gale howling about us. We are weak, writing is difficult, but for my own sake I do not regret this journey, which has shown that Englishmen can endure hardships, help one another, and meet death with as great a fortitude as ever in the past. We took risks, we knew we took them; things have come out against us, and therefore we have no cause for complaint, but bow to the will of Providence, determined still to do our best to the last. But if we have been willing to give our lives to this enterprise, which is for the honour of our country, I appeal to our countrymen to see that those who depend on us are properly cared for.

Had we lived, I should have had a tale to tell of the hardihood, endurance, and courage of my companions which would have stirred the heart of every Englishman. These rough notes and our dead bodies must tell the tale, but surely, surely, a great rich country like ours will see that those who are dependent on us are properly provided for.

(Signed) R. Scott

12.7. Appendix to Chapter 12 and Section 12.3.

In the advent of the brouhaha of the climate warming debate, a good number of researchers were looking at different climate proxies to enable researchers to reconstruct climate conditions of the past and present day. These climate proxies are "imprinted" in many natural phenomena like tree rings, ice core, ocean sediments, *etc*. But not only are natural proxies useful. Human recorded temperatures of sufficient length are also climate proxies.

One of the leading participants advocating the accuracy of the hockey stick is Dr Philip D. Jones who holds a professor position at the University of East Anglia, UK. According to Wikipedia, Dr Phil Jones maintains a time series of instrumental record of temperatures. Coincidently in 1990 he published a paper titled *Antarctic Temperatures Over the Present Century – A Study of the Early Expedition Record*.[155] In it the author reviews the air temperature records of "26 expeditions to Antarctica that have overwintered, for periods at least 9 months, between 1898 and 1958". Later by using 1957–75 average annual temperature data the author arrived at the conclusion that

> The best guess [*sic*] that can be made is that Antarctic air temperatures now appear to be warmer, by at least 1°C, than those prevailing [*sic*] during the first decade of the twentieth century. The result is broadly [*sic*] consistent with temperature changes that have been reported for both land and marine regions over the rest of the Southern Hemisphere.

Since we are accustomed to the temperature record of Captain Scott's expeditions, let us look more carefully at Dr Jones' work and analysis. Firstly, Dr Jones treats all expeditions' records as a complete and comparable record. He throws each expedition records into one bucket in order to figure out the annual average temperature at a given location. After obtaining the temperature data in such a way (see his Fig. 3), he compares with modern data at a given location.[156]

Firstly, as I depicted in Tab. 12.1, the expedition's data are not comparable, as they were taken at different time intervals and/or only during the day hours. For example, Cape Adare's data were only taken during the day hours and thus lower night temperatures are usually not included in the final annual average. From this, one may say that Dr Jones' figure is way too high. Due to gross negligence, temperature data for Cape Evans from September through December 1912 were not collected and only minimum and maximum temperatures are available. Therefore, comparing 8 months of 1912 averaged temperatures with the annual modern record is meaningless. Comparing Cape Evans' six four-hourly data recorded by the Ross Sea Party with modern is also pointless.

For those reasons, all data in Tab. 12.1 are in one way or another "defective" and unusable in comparison with the modern record. While taking average yearly temperatures, one must remember that Captain Scott's *Terra Nova Expedition* record is short of one month in 1911 and four months in 1912. Since Cape Adare is about 387 miles from Cape Evans, it is completely wrong to keep the temperature records of these two locations in the same bucket called McMurdo.

While looking at Dr Jones' paper, Dr Solomon, of course, could not resist sharing with the readers her insight into "Long-term trends in temperature at the … McMurdo

Table 12.1. Historical weather stations locations within the Ross Dependency with periods of air temperature record and temperature recording frequency.

Station	Period	Data Available
Cape Adare[1]	Feb. 1899	Interpolation
	Mar. 1899	Mean 9 am – 9 pm, 28 days
	Apr. 1899 – Dec. 1899	Mean 9 am – 9 pm
Hut Point[2]	Feb. 1902	Two-hourly values for 20 days
	Mar. 1902 – Jan. 1904	Two-hourly values
Cape Royds[3]	Mar. 1908 – Feb. 1909	Hourly values
Cape Evans[4]	Feb. 1911 – Aug. 1912	Hourly values
	Sep. – Dec. 1912	Maximum and minimum temperatures corrected by +0.7, +1.1, +0.4 and +0.3 respectively [°F]
Cape Adare[5]	Jan. – Feb. 1911	Interpolation
	Mar. – Dec. 191	Mean 8 am – 8 pm
Cape Evans[6]	Apr. – Dec. 1915	Six four-hourly observations
	Jan. – Dec. 1916	Six four-hourly observations

1 George C. Simpson, *British Antarctic Expedition, 1910–1913, Meteorology*, Vol. I, *Discussion*, Thacker, Spink and Co, Calcutta, 1919, *cf.* p. 81, Table 39.
2 *Ibid.*, *cf.* p. 80, Table 38.
3 *Loc. cit.*
4 *Loc. cit.*
5 *Ibid.*, *cf.* p. 81, Table 39. See also George C. Simpson, *Meteorology*, Vol. III, Tables, Harrison and Sons, Ltd., London, 1923, *cf.* p. 31, Table 3.
6 Fritz Loewe, *The Scientific Observations of the Ross Sea Party of the Imperial Trans-Antarctic Expedition of 1914–1917*, Institute of Polar Studies, Ohio State University, Cincinnati, 1963, *cf.* p. 29. http://kb.osu.edu/dspace/bitstream/handle/1811/51285/IPS_Report_5.pdf?sequence=1

Sound area" as she depicted on her Fig. 63.[157] Of course, she did not bother herself about the insufficient and short temperature record of the *Terra Nova Expedition* as I depicted in Tab. 12.1. How did she calculate an *annual average* of temperature for 1912 year, if the 1912 record is short of data from September through December 1912? How did she calculate the annual average temperature for 1902 if Captain Scott's record is short of data for Jan. 1st through Feb. 8th, 1902?

Chapter 13

Synopsis – Never Again

> *Unless I am convinced by Scripture and plain reason – I do not accept the authority of the popes and councils, for they have contradicted each other – my conscience is captive to the Word of God. I cannot and I will not recant anything for to go against conscience is neither right nor safe. God help me. Amen.*
>
> Martin Luther

This book is nothing less than a daring challenge to the prevailing views of Captain Robert F. Scott's journey to the South Pole and consequent disaster. Borrowing from various scientific disciplines, I lucidly argued against each of the presumed causes of Captain Scott and his companions' deaths. In particular, I demolished the notions of extreme low temperatures, ferocious winds, and food/fuel shortages as the main causes of the disaster. Using neural network computer simulations, I proved that the *Extreme Cold* Snap, *Super Extreme Cold Snap*, *Never Ending Gale*, and food/fuel scarcity never occurred. I eliminated the alleged causes of the disaster, and also provided data and arguments that the deaths of Captain Scott, Dr Wilson, and Lt Bowers were a matter of choice. The choice was made during the return leg over the Antarctic Plateau long before there was an actual end of food/fuel and long before the end of physical strength needed to reach delusive salvation at One Ton Depôt.

While presenting Captain Scott's journey to the South Pole, the authors of other works entirely neglected (ignored) fundamental (basic) issues of its logistics. In this book, I delivered my verdict from digitizing the logistics of the South Pole journey and the weather conditions reported by Captain Scott and the shore party at Cape Evans. Based on that and subsequent analysis, an entirely new insight has emerged on all aspects of the journey and ultimate deaths of Captain Scott's party. This insight vitally challenges all previous work on the fate of Captain Scott's party. My findings must be divided into two categories: one praising and one critical of Captain Scott's actions.

In particular these findings *appreciating* Captain Scott's leadership include:

1. Fine and accurate plans for the polar journey and the following execution (section 9.4),
2. Brilliant arrangement of plans to take the Fifth Man (Bowers) to the Pole (subsection 11.1.8),
3. Fine and sustained sledging velocity until Feb. 2nd, 1912 (Chapters 9 and 11).

Conversely the *unfavorable* findings include alleged causes of disaster, physical phenomena related to them, and Captain Scott's actions, which are divided into the following categories:

1. Meteorological events or weather data that *never occurred or existed*:
   - 1.1. Meteorological events reported by Captain Scott:
     - 1.1.1. *Extreme Cold Snap* – February 27th through March 19th, 1912 (Chapter 7),
     - 1.1.2. *Super Extreme Cold Snap* – February 27th through March 27th, 1912 (Chapter 7),
     - 1.1.3. *Never Ending Gale* – March 21st through 29th, 1912 (Chapter 8),
     - 1.1.4. Miscellaneous and numerous exaggerations as described at various occasions through this book.
   - 1.2. Temperature data attributed to Captain Scott by various authors:
     - 1.2.1. Leonard Huxley's temperature lowering (section 2.2),
     - 1.2.2. Dr Solomon's multiple temperature data dragging and falsifications (fallacious meteorological analyses and comments) (Chapter 4),
     - 1.2.3. Sir Ranulph Fiennes' temperature and wind velocity exaggerations and inventions (section 5.2),
     - 1.2.4. Huntford, Dr Barczewski, and Dr Jones' miscellaneous meteorological misconduct (Chapter 5).
2. Weather events that occurred but *did not* lead to disaster:
   - 2.1. Gale at 83°S (Four Days Blizzard) (subsection 11.1.6),
   - 2.2. Soft Snow at Beardmore Glacier (subsection 11.1.7).
3. Actions and/or events that taken individually or in total *did not* lead to disaster:
   - 3.1. Reported by Captain Scott:
     - 3.1.1. The Loss of Ponies in March 1911 (subsection 11.1.1),
     - 3.1.2. Fuel Leakage (subsection 11.1.9),
     - 3.1.3. Food Shortages (subsections 9.4 and especially 11.1.10),
   - 3.2. Proposed and considered in various post-expedition analyses (subsections 11.1.2 through 11.1.14):
     - 3.2.1. One Ton Depôt Location (79°28½′S, 170°E),
     - 3.2.2. Complexity of Transportation Methods,
     - 3.2.3. Misuse of the Dog Team,
     - 3.2.4. Navigation and Navigation Methods,
     - 3.2.5. Gale at 83°S,
     - 3.2.6. Soft Snow at Beardmore Glacier,
     - 3.2.7. The Fifth Man,
     - 3.2.8. Fuel Leakage,
     - 3.2.9. Food Shortages on the Barrier,
     - 3.2.10. Collecting and Hauling Geological Specimens,
     - 3.2.11. Vitamin Deficiency,
     - 3.2.12. Neglecting the Sick,
     - 3.2.13. Route Marking and Depôt Laying.
     - 3.2.14. Dr Simpson and Dr Atkinson's mutiny (Chapter 10).

4. Captain Scott's account of causes of disaster as described in the *Message to the Public* which:
   4.1. *Did not lead* to disaster:
      4.1.1. The loss of ponies in March 1911 (subsection 11.1.1),
      4.1.2. Gale at 83°S (subsection 11.1.6),
      4.1.3. Soft snow at Beardmore Glacier (subsection 11.1.7),
   4.2. The events which *did not occur*:
      4.2.1. February 27th through March 27th, 1912 – *Extreme Cold Snap* and *Super Extreme Cold Snap* (Chapter 7 and subsection 11.3.3),
      4.2.2. March 21st through 29th, 1912 – *Never Ending Gale* (Chapter 8 and subsection 11.3.4).
   4.3. The events which only towards the very end of March could lead to the party's deaths:
      4.3.1. Food shortages on the Barrier (subsection 9.4),
      4.3.2. Fuel shortages on the Barrier (subsection 9.4).

In subsection 12.4.1, I identified and described the events which, combined with the above facts, constitute the scientific and circumstantial evidence of altruistic suicide by Captain Scott's party. These events include:

1. Event 1 – From the beginning of February 1912 the *sustained* sledging velocity of the party *steadily* decreased,
2. Event 2 – On Feb. 6th, 1912 Captain Scott started and continued until the end of March 1912 to forge data about food and fuel shortages,
3. Event 3 – Lt Bowers ceased keeping his diary altogether at Upper Glacier Depôt on Feb. 7th, 1912. On Jan. 30th Lt Bowers ceased regular diary entries,
4. Event 4 – On Feb. 8th and 9th the party geologized along Mt Buckley,
5. Event 5 – On Feb. 17th Captain Scott likely fabricated the attempted abandonment of Edgar Evans (and not the specimens) in a false show of determination to get home,
6. Event 6 – From Feb. 18th the party after passing the Shambles Camp pony corpses (five + one more a few miles away) and other pony corpses (four) along the return route, almost entirely ignored the available pony meat,
7. Event 7 – On Feb. 27th Dr Wilson ceased keeping his diary,
8. Event 8 – February 27th through March 27th, 1912 – *Extreme* and *Super Extreme Cold Snap*,
9. Event 9 – On Feb. 24th Captain Oates ceased keeping his diary. On Mar. 16th Captain Oates committed suicide,
10. Event 10 – March 21st through 29th 1912 – *Never Ending Gale*.

Considering investigation and disclosure of all facts as summarized above and described in detail in previous chapters, I deduce that the presented evidence is substantial and sufficient to conclude that Captain Scott at his party committed altruistic suicide by deciding to not return to home base at Hut Point/Cape Evans for the sake of utilitarian doctrine – the greatest happiness of the greatest number of people – and for self-immolation through the sham and pretence of submission to science, nation and nature.

I can best state my wishes by repeating the title of the final chapter of *The Worst Journey in the World*: "Never Again."

Chapter 14

Appendixes

14.1. Appendix 1 – Geographical Locations

The Gazetteer of elected geographic coordinates of various sites related to the analysis presented in the book. Since the Ross Ice Shelf is continuously flowing toward the Ross Sea (see subsection 10.8.1 for detailed ice velocities) the locations of Automated Weather Stations (AWS) are only approximate. The tilde indicates approximate longitude of Captain Scott's camps.

Name	Latitude	Longitude	Latitude	Longitude	Remarks
Axel Heiberg Glacier	85°25′S	163°0′W	–85.416667	–163	Entrance
Beardmore Glacier	83°45′S	171°00′E	–83.75	171	Entrance
Bernacchi Bay	77°27′S	163°50′E	–77.45	163.833333	
Bay of Whales	78°30′S	164°20′W	–78.5	–164.33333	
Cape Armitage	77°51′S	166°40′E	–77.85	166.666667	
Cape Bernacchi	77°29′S	163°51′E	–77.483333	163.85	
Cape Bird	77°10′S	166°41′E	–77.166667	166.683333	
Cape Crozier	77°30′0″S	169°20′E	–77.5	169.333333	
Cape Evans	77°38′0″S	166°24′E	–77.633333	166.4	
Cape Royds	77°33′S	166°9′E	–77.55	166.15	
Corner Camp	77°54′0″S	167°17′E	–77.9	166.283333	
Cloudmaker	84°17′S	169°25′E	–84.283333	169.416667	2,680 m
Elaine AWS	83°5′S	174°17′E	–83.094	174.285	58 m
Eric AWS	81°29′S	163°56′E	–81.496	163.947	45 m
Ferrar Glacier	77°49′S	162°42′E	–77.816667	162.7	Entrance
Ferrell AWS	77°55′0″S	170°49′E	–77.916666	170.816666	43 m
Framheim	78°30′S	164°00′W	–78.5	–164	
Granite Harbour	76°53′S	162°44′E	–76.883333	162.733333	
Hut Point	77°47′0″S	166°51′E	–77.783333	166.85	
Inaccessible Island	77°40′S	166°22′E	–77.666667	166.366667	

Name	Latitude	Longitude	Latitude	Longitude	Remarks
Last Camp*	79°50′S	~170°E	–79.83333	170	
Last Depôt	89°32′S	~160°E	–89.53333	160	
Lettau AWS	82°28′S	174°32′W	–82.475	–174.538	37.9 m
Linda AWS	78°26′S	168°24′E	–78.439	168.406	43 m
Lower Barrier Depôt	82°47′S	~170°E	–82.783333	170	
Lower Glacier Depôt	83°36′S	~170°E	–83.6	170	
Marble Point	77°26′S	163°50′E	–77.433333	163.833333	
McMurdo Station	77°51′S	166°40′E	–77.85	166.666667	
Mount Buckley**	84°58′S	163°56′E	–84.966667	163.933333	2,645 m
Mount Darwin	85°2′S	163°8′E	–85.0333333	163.133333	2,500 m
Mount Erebus	77°31′4″S	167°09′12″E	–77.529722	167.153333	3,794m
Mount Hooper***	80°32′S	~170°E	–80.533333	170	
Mount Hope	83°45′S	171°00′E	–83.75	171	1,100 m
Mount Terror	77°31′S	168°32′E	–77.516667	168.533333	3,240 m
Middle Barrier Depôt	81°35′S	~170°E	–81.58333	170	
Middle Glacier Depôt	84°24′S	~170°E	–84.40	170	
Minna Bluff	78°30′S	169°0′E	–78.50	169	
One Ton Depôt	79°28½′S	169°22′E	–79.475	169.366666	
Safety Camp	77°54′S	167°17′E	–77.9000	167.2833	
Schwerdtfeger AWS	79°52′30″S	170°6′18″E	–79.875	170.105	54 m
Scott Base	77°51′S	166°45′E	–77.85	166.75	
Shambles Camp	83°30′S	~170°E	–83.50	170	52 m
Three Degree Depôt	86°56′S	~165°6′E	–86.933333	165.10	2,863 m
Turks Head	77°40′S	166°44′E	–77.666667	166.733333	
Upper Barrier Depôt***	80°32′S	~170°E	–80.533333	170	
Upper Glacier Depôt	85°7′S	163°4′E	–85.116666	163.066666	2,180 m
Windless Bight	77°42′S	167°40′E	–77.7	167.666667	
1½° Depôt	88°29′S	159°33′E	–88.483333	159.550	

* See section 10.6 for analysis and discussion of the true location of the Last Camp.

** Sometimes called Buckley Island.

*** Locations of Mount Hooper and Upper Barrier Depôt are the same.

14.2. Appendix 2 – Errors and Fallacies in Drs Solomon and Stearns paper *On the Role of the Weather in the Deaths of R. F. Scott and his Companions*

In the Nov. 9th, 1999 issue of the Proceedings of the National Academy of Sciences of the United States of America, (henceforth PNAS), an article appeared co-authored by Drs Susan Solomon and Charles R. Stearns.[1]

The title of the paper was *On the Role of the Weather in the Deaths of R. F. Scott and his Companions*. Its PDF version is readily available.[2] In section 4.1, I discussed this article's most glaring errors and fabrications. In here for the sake of completeness I will point out additional errors.

This Appendix contains two complementary sections. The second section is a PDF copy of Drs Solomon and Stearns' original article with highlighted by me text, whose erroneous meaning is subsequently commented on in the first section.

General Comment: Their entire article is dogged by the fundamental issue which is summarized by the authors at the beginning of their article in the bold faced abstract. The authors' explanation of their discovery is counterfactual to what is known from Captain Scott's journal and particularly from his *Message to the Public*. The authors hide from the readers that Captain Scott while enumerating causes of disaster described that

> On the Barrier in lat. 80°, 10,000 feet lower [then Antarctic Plateau – KS], we had –30° in the day,–47° at night pretty regularly, with [the – KS] continuous head wind during our day marches. It is clear that these circumstances come on very suddenly, and our wreck is certainly due to this sudden advent of severe [*sic*] weather, which does not seem to have any satisfactory cause.

It is evident that according to Captain Scott the weather was "severe" and occurred "sudden[ly]".

1. … 170 miles… – throughout the paper Drs Solomon and Stearns use the English system of measurement. Their temperatures are given in degrees Fahrenheit denoted by °F and their distances in statute miles, which are equivalent to 0.868976 of a geographical (or nautical) mile. Captain Scott as well I in this book used geographical miles. Dr Solomon's location of the last camp at "170 miles from their base camp" should read $170 \times 0.869 = 147.7$ geographical miles. Therefore, Dr Solomon is suggesting the last camp was 148 geographical miles from the base camp. Either way, from Cape Evans or Hut Point, it is a wrong figure. See also section 10.6.
2. … it has been assumed … – it is a nonsense statement. From Captain Scott's journal and more particularly from his *Message to the Public* everybody knows about the "surprise which awaited us on the Barrier … no one in the world would have expected the temperatures and surfaces". To show that the temperatures were unusual, Captain Scott fabricated the *Extreme and Super Extreme Cold Snaps*. This false and tortuous sentence defines the purpose of Drs Solomon and Stearns' paper as they aim to prove that the weather conditions were unusual.

3. Only 1 year … – for analysis of this counterfactual, erroneous and fallacious conclusion, see subsection 4.1.1.
4. … available 15 years … – this is an incorrect figure. See subsubsection 4.1.1.
5. … more than 900 miles … – of course, this figure as a distance sledged by Captain Scott from Hut Point to the South Pole is incorrect and it should be ~862 US statute miles, equivalent to 749 geographical miles.
   … more than 1,600 miles … – one more time, Drs Solomon and Stearns' figure of summary distance sledged by Captain Scott's party is incorrect. Captain Scott's party sledged 749 + 749 – 118 – (11 or 22) = 1369 geographical miles which is equal to 1575 US statute miles. However, the last camp was 22 miles from One Ton Depôt (see section 10.6) the distance sledge by the party was 1358 geographical miles which gives 1563 US statute miles.
6. … roughly 79.6°S, 170°E … – this figure for last camp location is incorrect. Converting a decimal latitude 79.6° to sexagesimal (base 60 – a numerical system with sixty as its base) one gets 79°36′S as for its location according to Drs Solomon and Stearns. The actual location of the last camp was 79°50′S (see section 10.6 for analysis and discussion of the true location of the Last Camp).
7. … 170 miles from … – see the above point 1 for comments.
8. … severe weather … – the authors acknowledge that according to Captain Scott's journal, the weather conditions in late February and March were severe. Of course, this is on the contrary to their thesis as described in point 2 above.
9. Captain Scott experienced … – in this line the authors contradict their own thesis as given in point 2.
10. Some factors that are … – This account of factors contributing to the Captain Scott party's disaster ends with citation of Cherry-Garrard's book as a source of these factors. However, that is an unscientific approach by Drs Solomon and Stearns. By consulting Cherry-Garrard's book, it is evident that he presented a number of guesses and did not present scientific analysis to prove his observations. Thus, in this case, his and Drs Solomon and Stearns' statements do not meet the criterion of falsifiability.
11. … a deep layer of soft snow that impeded their progress (7). – A strange citation of reference (7) which is Dr Werner Schwerdtfeger's book with a lamenting account of Captain Scott's account of a gale at 83°S. For more on that, see section 4.1.
12. Scott's and Simpson's statements … – To literally suggest that many thousands of readers "ignored" Captain Scott's journal and especially his "statements regarding the temperatures in March of 1912" in the *Message to the Public* is nonsense and insults the readers. The investigative reader at this moment may also consult Chapter 2 to find who and why "explicitly dismissed suggestions of severe weather".
13. Fig. 1. Map of the Antarctic … Contemporary automated weather stations … numbered 1 through 5 … This figure illustrates what poor science and what a mess is presented in the authors' article:
    13.1. This is not a map as it is out of scale, and the Last Camp on this map is about 175 geographical miles, instead of l40 geographical miles, from Hut Point/Cape Evans,

13.2. Firstly let me recall that temperature data were recorded at Cape Evans and by Captain Scott's party along their return route,
13.3. Cape Evans is hastily indicated on this map somewhere in between stations l (Marble Point) and 2 (Ferrell AWS).
13.4. Station 3, which is Schwerdtfeger AWS, should be depicted much closer to the Last Camp. Provided a continuous Barrier flow (see section 10.9) the Schwerdtfeger AWS is flowing northward. The station 4 is Elaine AWS and should be depicted closer to the foot of the Beardmore Glacier (see Appendix l – Geographical Locations).

14. Consistent observations from … – This is an entirely false argument of ±0.5°C modern thermometer measurements. Drs Solomon and Stearns' "consistent" (what is the meaning of this word) observations due to temperature gradients between stations at different locations prove nothing on their own.
15. … Scott's "*via dolorosa*" … – this term was originally used by Cherry-Garrard and later by Roland Huntford and it should be acknowledged as such by Drs Solomon and Stearns.
16. Hourly measurements were made throughout 1911 and 1912 … – This is a false statement. Hourly temperature measurements at Cape Evans were taken from Feb. 1911 through Aug. 1912, at which point they inexplicably ended. See Table 12 for more.
17. Fig. 2. Averaged monthly temperature climatologies [sic] … – This figure is a complete mess of many issues. The plotted data of course does not reflect the climatology of the region due to insufficient length of data!
18. This comparison broadly … – an entirely unscientific comment pretending to be scientific. Without the error bars, Drs Solomon and Stearns' Fig. 2 to which this comment is referring is pointless. See also point 18 above.
19. Marble Point, located at 77.44S° … – throughout the paper the authors use the Marble Point AWS data to argue their case. However, Cape Evans and Marble Point are entirely different locations and comparing the respective temperature records is pointless.
20. Simpson (ref. 4, pp 21–33) carefully examined … – we do not know how careful Dr Simpson was in his work. We only know its results. These results were critically examined in Chapter 3 and many of them show that Dr Simpson confused climate and weather.
21. His estimate of the likely annual cycle … – Drs Solomon and Stearns' suggestion of Dr Simpson having remarkable talents of estimating mean Barrier temperatures from a very few data points, as compared with 1985–1998 data points (5112 (approximate figure)) used by the authors, calls for attention and is telling. See Fig. 3.13 for a detailed description.
22. Fig. 3. Observations of daily minimum temperatures … – there are multiple problems with this figure. See subsection 4.1.1 for detailed critical analysis.
23. Although such observations may be biased … – see subsection 4.1.1. for critical examination.
24. The average of the daily minima … – this is mathematical nonsense to calculate a standard deviation of averaged variable. See subsection 4.2.3. In here one should also observe that Drs Solomon and Stearns presented false citation of Dr Simpson, who actually said the bias was caused by lack of exposure to the

sun: "Nearly all the sledging thermometers (spirit) were provided with minimum indices, and after the sledge had been straightened for the night the open thermometer was carefully placed under the sledge in such a position that it was shielded from radiation. There is little doubt that a thermometer so placed gave minimum temperatures too low by a degree or two, but it will be shown that the minimum temperatures are of great value and cannot be neglected in obtaining the mean temperature for the day."

25. Fig. 4. Average of daily minimum temperatures … – see subsection 4.1.1 for critical examination of this figure.
26. … extreme hunger … – if Drs Solomon and Stearns were careful, they could find that the party was sledging on full food rations. For more on this issue see section 9.4.
27. Fig. 3 reveals that the minimum daily temperatures … – See point 24 above.
28. … March 12, when the sling thermometer broke … – Lt Bowers broke the sling thermometer on March 10th, 1912.
29. … every day of available measurement … – this is not an accurate statement. After Lt Bowers broke the sling thermometer on March 10th the available record is not a minimum temperature record but, rather the temperatures reported by Captain Scott in his journal.
30. … data for 14 and 15 years (respectively) at two nearby sites as shown … – see point 34 and Chapter 4.1.1.
31. Only 1 out of, 15 years of modern data … – see point 34.
32. … missing data reflect occasional instrument failures … – missing data mentioned by the authors are meant to confirm their incorrect statements in points 32 and 33 above and downplay the severity of the missing data.
33. Only 1 in the modern record seems to rival the severity of the temperatures measured in 1912, broadly consistent with Simpson's conclusions that conditions would likely have been milder in roughly 9 out of 10 years … – this is a misattribution of a statement by Cherry-Garrard, who in his book used a hypothetical meteorologist as a rhetoric piece to make this statement. "Nine times out of ten, says the meteorologist, he would have come through: but he struck the tenth".[3] Therefore, Drs Solomon and Stearns' confirmation of "broad consistency" is wrong. Besides, if one takes Drs Solomon and Stearns' result, "l out of 15", then the real probability is significantly reduced to ~0.6 out of 10 years.
34. These observations suggest long term trends in annually averaged … – Dr Jones' work was critically examined in section 12.7 where his wrong calculations were pointed out.
35. It is intriguing to note that 1912 was an El Niño year (25) … – Much more many intriguing events happened in 1912, including Captain Scott's return from the Pole. See Chapter 4.2.4 for why Drs Solomon and Stearns' statement is meaningless.
36. … about 15 miles per day had been achieved on the outbound … – wrong figure. Captain Scott's party sledged at about 14.5 miles/day during the outbound journey. See Fig. 4.12 and 4.11. See also particularities in subsection 11.1.8.
37. Scott's diary is not specific as to the wind speeds during this period … – Drs Solomon and Stearns are incorrect. Captain Scott explicitly informed us that this was a *gale*, or Beaufort force 8.

38. Peak daily winds in excess of 30 km/hour … – by significantly lowering wind duration and its velocity from 63–87 km/h (gale) to 30 km/h (fresh breeze 28.7–38.8 km/h), Drs Solomon and Stearns cheated the readers to conclude that: "Hence, windy conditions do not appear to be highly unusual for this location and time of year."
39. The financial support of the National Science Foundation for this network is gratefully acknowledged … – all of this from point 1 to point 40, and through this PNAS paper her fraudulent book, were financially supported by the NSF.

On the role of the weather in the deaths of R. F. Scott and his companions

Susan Solomon*† and Charles R. Stearns‡

*Aeronomy Laboratory, §National Oceanic and Atmospheric Administration, Boulder, CO 80303; and ‡Department of Atmospheric and Oceanic Science, University of Wisconsin, Madison, WI 53706

Edited by James E. Hansen, Goddard Institute for Space Studies, New York, NY, and approved August 27, 1999 (received for review June 21, 1999)

Robert Falcon Scott and his companions reached the South Pole in January of 1912, only to die on their return journey at a remote site on the Ross Ice Shelf, about 170 miles from their base camp on the coast. Numerous contributing causes for their deaths have been proposed, but it has been assumed that the cold temperatures they reported encountering on the Ross Ice Shelf, near 82–80°S during their northward trek toward safety, were not unusual. The weather in the region where they perished on their unassisted trek by foot from the Pole remained undocumented for more than half a century, but it has now been monitored by multiple automated weather stations for more than a decade. The data recorded by Scott and his men from late February to March 19, 1912, display daily temperature minima that were on average 10 to 20°F below those obtained in the same region and season since routine modern observations began in 1985. Only 1 year in the available 15 years of measurements from the location where Scott and his men perished displays persistent cold temperatures at this time of year close to those reported in 1912. These remarkably cold temperatures likely contributed substantially to the exhaustion and frostbite Scott and his companions endured, and their deaths were therefore due, at least in part, to the unusual weather conditions they endured during their cold march across the Ross Ice Shelf of Antarctica.

In November of 1911, Captain Robert Falcon Scott led a team of men south from their base at Cape Evans on McMurdo Sound, striving to be the first to arrive at the South Pole and to claim this historic achievement in exploration for Britain. They marched and skied over the Ross Ice Shelf, up the Beardmore Glacier, and across the south Polar Plateau for more than 900 miles (see Fig. 1), reaching the Pole in January, 1912. There they found what they had feared—the flag of Norway, which had been planted by Roald Amundsen and his team almost a month earlier. Scott and two remaining companions ended their terrible trek of more than 1,600 miles near the end of March, 1912, in a tent at roughly 79.6°S, 170°E, about 170 miles from the safety of their base, after completing an epic journey wholly by foot in the most inhospitable place in the world (ref. 1; ref. 2, p. xxxviii).

As they marched to their deaths, some of the men kept journals. On February 27, 1912, E. A. Wilson ended his very last diary entry with the stark words "Turned in at −37 (°F)" (ref. 3, p. 245). Scott continued writing, and on March 10, 1912, he wrote that "the weather conditions are awful" (ref. 1, p. 588). In his last days, Scott also penned numerous farewell letters. Among these was a "Message to the Public," in which he presented his view of the problems that had plagued their expedition (such as the loss in the previous summer of several of the ponies that were used to pull their supplies part of the way). But he stressed that "all the facts above enumerated were as nothing to the surprise which awaited us on the Barrier . . . our wreck is certainly due to this sudden advent of severe weather, which does not seem to have any satisfactory cause" (ref. 1, p. 606).

The meteorologist of Scott's expedition was George C. Simpson, who left Antarctica before Scott's body was found. In 1919, Simpson published a three-volume treatise reporting his pioneering studies of polar meteorology; in that work he concluded that "Captain Scott experienced unusually low temperatures on his return from the pole" (ref. 4, p. 32). Simpson is quoted by another surviving member of the expedition as stating that the polar party would have survived in 9 of 10 years, but struck the 10th unlucky one (ref. 2, p. 594).

History at first lionized Scott as a hero, but later studies raised questions about his leadership. Some factors that are often suggested as contributing to the lethal end of his trek include the general health of his ponies when purchased, the reliance primarily on man-hauling and on ponies (rather than sled dogs) to transport supplies, the lack of experience with skis, and the decision to include five men in the polar party rather than the original plan of four (ref. 2, pp. 565–566). Vitamin deficiencies such as scurvy or pellagra (attributable to poor diet) have frequently been advanced as the primary cause of his demise (5, 6). A blizzard that struck the team near 83°S while en route to the pole in December, 1911, also added to the expedition's difficulties by laying down a deep layer of soft snow that impeded their progress (7). Remarkably, Scott's and Simpson's statements regarding the temperatures in March of 1912 have been largely ignored. A few authors explicitly dismissed suggestions of severe weather (8), perhaps because such conditions were assumed to be typical for the harsh climate of Antarctica.

It is not our goal to evaluate the relative contributions of each of the many factors that could have played some role in the fatal outcome of Scott's polar journey. Rather, we focus in this paper only on the question of whether the temperatures encountered in the last month of the lives of Scott and his companions posed an unusual challenge in the final stages of their struggle for survival. We will show that observations made possible only by modern meteorological instruments that began recording data more than half a century after Scott's death indeed demonstrate that he and his men perished following a battle with conditions far colder than average for this region of the Ross Ice Shelf.

Meteorological Data: Historical and Modern

Temperatures have been routinely measured at a handful of manned Antarctic stations since about the 1950s, but most of these are located near the coast. The inland temperatures of the region of the Ross Ice Shelf where Scott and his men ended their march (see Fig. 1) have remained largely undocumented until about the past two decades. Even today, accurate and representative measurements of surface temperature can only be made by local methods, because the steep inversions, low-level clouds, and ice fog that frequently prevail in the Antarctic render

This paper was submitted directly (Track II) to the PNAS office.

Abbreviation: ENSO, El Niño Southern Oscillation.

†To whom reprint requests should be addressed at: 4360 Hanover, Boulder, CO 80303. E-mail: ssolomon@uswest.net.

§The views presented in this paper are those of the authors and not an agency position on the part of the National Oceanic and Atmospheric Administration.

The publication costs of this article were defrayed in part by page charge payment. This article must therefore be hereby marked "*advertisement*" in accordance with 18 U.S.C. §1734 solely to indicate this fact.

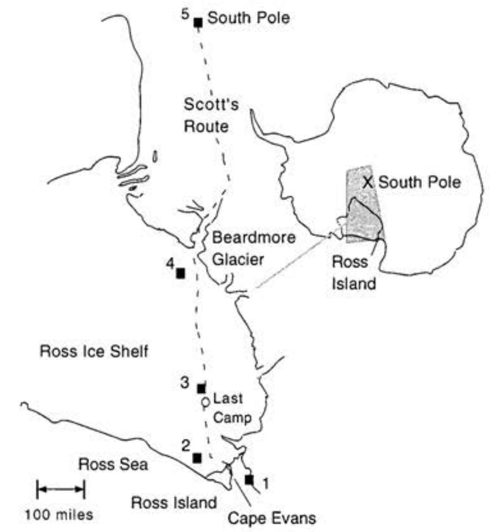


Fig. 1. Map of the Antarctic, with expanded view of the Ross Ice Shelf across which Scott and his men marched. Their base camp was located at Cape Evans on Ross Island, and they traveled south near the 170°E meridian to the South Pole. Contemporary automated weather station sites near their route are numbered 1 through 5.

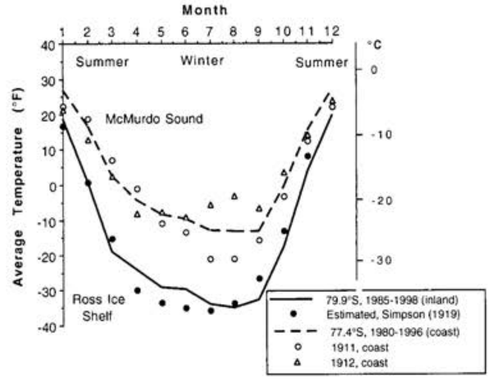


Fig. 2. Averaged monthly temperature climatologies from the automated weather stations (see Fig. 1) at McMurdo Sound (dashed line, Marble Point data for 1980–1996) and for the Ross Ice Shelf at 79.9°S (solid line, station 3 of Fig. 1, for 1985–1998). The open symbols show meteorological data taken at Cape Evans on McMurdo Sound during Scott's expedition in 1911 and 1912 (ref. 4, p. 11), which agree well with the nearby Marble Point data. The closed symbols show Simpson's estimate of the likely annual cycle of temperature on the ice shelf (see text).

satellite techniques of limited use in detecting the temperature at the ground. Beginning in the early 1980s, a network of automated weather stations was installed at remote sites around the continent, allowing for routine measurements of surface temperature, pressure, wind, and humidity (see ref. 9 for details of the instrument design and data quality checks). Data are reported every 10 minutes and are transmitted in real-time. Temperatures are measured by solid platinum wire resistance thermometers and are calibrated and read out to an accuracy of better than ±0.5°C; the precision is mainly limited by the digitization currently employed. Consistent observations from adjacent but independent stations provide support for the overall accuracy of these unattended measurements. A primary purpose of these automated measurements is to improve aviation safety, and their locations near the U.S. base at McMurdo Sound on Ross Island and at a few remote places between McMurdo and South Pole stations reflect this objective. The meridian near 170°E also served as Scott's "*via dolorosa*," along which he and his men marched to the South Pole and nearly all the way back. Fig. 1 shows the locations of the automated weather stations to be considered here, along with the route traversed by Scott and his companions in 1912.

Scott's expedition had dual goals of exploration and science. The meteorological instruments used were of high quality for their time and were carefully calibrated against standards at Kew Observatory in London to an estimated accuracy of better than ±0.5°F (ref. 4, pp. 16–17). Hourly measurements were made throughout 1911 and 1912 at the expedition's base at Cape Evans (see Fig. 1) with multiple instruments. During journeys away from the base, temperature was measured by using alcohol- or toluene-based sling thermometers, because mercury could freeze at the temperatures encountered. All of the temperatures henceforth will be given in degrees Fahrenheit (°F) to maintain consistency with the historical documents.

The monthly averaged observations made at Cape Evans during 1911 and 1912 (ref. 4, p. 11) are compared with the long-term average provided by 17 years of automated weather station data that are now available from the site at Marble Point on McMurdo Sound (station 1 in Fig. 1) in Fig. 2. This comparison broadly supports the accuracy of Simpson's calibration standards.

The rapid onset of Antarctic winter cooling after the summer solstice was expected by Scott and his meteorologist, based largely on observations carried out during Scott's previous south polar expedition of 1902–1904 (ref. 4, pp. 85–91). Simpson also recognized that the climate in the region of McMurdo Sound is moderated in part by the relative warmth of the nearby ocean (ref. 4, p. 93), so that the surface temperatures of the continental interior would be considerably colder than those on the coast, even at sea level. More recent studies also show that the blocking effects of surrounding surface topography further moderate the climate on Ross Island (10). The large temperature differences between the averaged monthly data for the coastal automated weather station at Marble Point, located at 77.44°S, and that inland on the Ross Ice Shelf, at 79.9°S (station 2 in Fig. 1), are illustrated in Fig. 2.

Simpson (ref. 4, pp. 21–33) carefully examined the temperature data gathered on a very limited number of exploratory treks away from the coast to derive the typical temperature differences expected to occur between Cape Evans and the "Great Barrier" (now known as the Ross Ice Shelf). He combined these temperature differences with the 2-year record of hourly data at Cape Evans to deduce the annual cycle of temperature that would normally be expected in the nearly unexplored inland regions. His estimate of the likely annual cycle of mean Barrier temperatures agrees remarkably well with the climatology that has now been established by multiple years of continuous data via the automated weather station data as shown in Fig. 2.

The Cold March of 1912

Scott and his four companions began their long march back to the coast from the South Pole on January 19, 1912. At an elevation of over 10,000 feet, the average temperatures of the

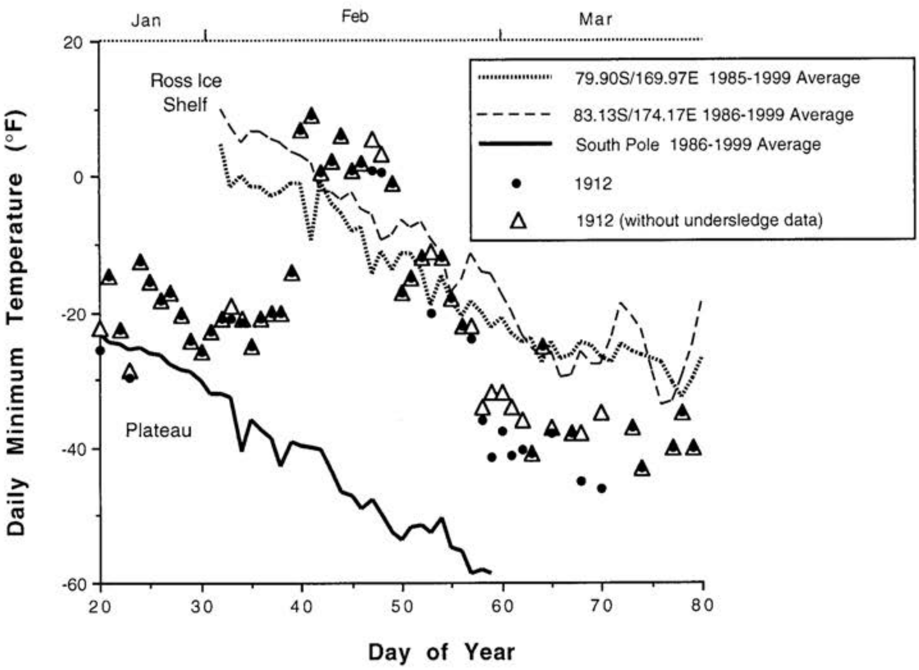


Fig. 3. Observations of daily minimum south polar temperatures. Open triangles show the 1912 ventilated data only, whereas filled circles display minima considering available under-sledge daily measurements (11), beginning near the South Pole on January 20 (day number 20), descending to the Ross Ice Shelf near February 1–14 (days 32–45), and continuing until March 19. The rapid warming between days 40 and 45 is caused by the descent from the high plateau at about 10,000 feet elevation to near sea level. The heavy black line shows the average daily minimum at the South Pole (station 5) from automated weather station data, while the two broken lines show the observations from stations at 79.9°S and 83.13°S (stations 3 and 4 in Fig. 1).

south polar plateau remain below freezing even at the height of austral summer. The sling thermometer was typically used to record the 1912 temperature three times per day: just before the daily march, during the lunch halt, and while the evening meal was prepared (11). Fewer observations were taken on many days, probably because of observer fatigue. The precise daily averaged temperatures experienced by Scott and his men are uncertain because three observations, at most, were made each day (ref. 4, pp. 17–20). Rather than attempting to construct an average from these sparse measurements, in this paper we examine the daily minimum temperatures that can be derived from the data obtained by Scott and his companions in 1912, and compare these with modern observations. At night, the sling thermometer was sometimes placed under one of the wooden sledges (a type of sled that carried supplies) to shield it from the sun and to estimate the nightly minimum temperature. Although such observations may be biased low by up to 2° because of the pooling of cold air (ref. 4, p. 19), the ventilated data taken while swinging the thermometer only a few times per day are likely to be warmer than the actual daily minimum. It is therefore probable that the true 1912 minima lie between the ventilated and under-sledge data; both will be shown here where available.

The minimum daily temperatures played a large role in the physical discomforts reported by Scott and his companions. The men sometimes complained of the wind, but even under very cold conditions the strenuous labor of the march while hauling their equipment was usually sufficient to make even rather windy days more comfortable than the nights (ref. 2, pp. 242–244, 248, 291, 302). The men's concerns were generally less focused on wind chill than on the air temperature. Cold nighttime temperatures were particularly dreaded, as these rendered their sleeping bags frozen and uncomfortable, making "life at night a clammy misery" (12).

Simpson (ref. 4, pp. 19–21) demonstrated that three independent sledge thermometers used by different parties involved in the first stage of the polar trek, during November 1911, agreed with one another to within a few degrees, supporting the measurement precision. Only one group continued to the South Pole, carrying one of these three instruments. Scott and his team were within 1° of latitude of the geographic South Pole from January 13 to 23, 1912. The average of the daily minimum temperatures recorded by them during these dates is −23°F, considering only the ventilated measurements, and −24.1°F, when the available under-sledge data are also included in the mean (11). The intense solar illumination at the South Pole in summer renders the temperatures relatively consistent there from year to year in this period. The average of the daily minima for January 13–23, recorded annually by the automated weather station at the Pole since 1986, is −22.6°F, with a SD of 3.7°F, which is in good quantitative agreement with Scott's 1912 data and thus further supports the measurement accuracy.

Fig. 3 shows the daily minimum temperatures encountered by Scott's party as they struggled to return from the Pole in 1912 (11). The 1912 data are compared with the average daily minima from automated weather station data at the South Pole, at 83.13°S, and at 79.9°S (stations 5, 4, and 3 in Fig. 1) obtained over

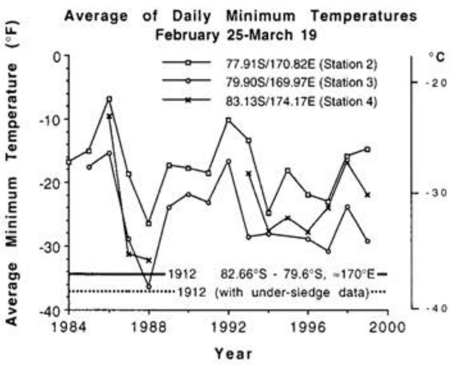


Fig. 4. Average of daily minimum temperatures for February 25–March 20 on the Ross Ice Shelf. Data for 1912 both with and without the inclusion of under-sledge nighttime minima (see text) are compared with measurements made by the automated weather stations at 77.91°S, 79.9°S, and 83.13°S (stations 2, 3, and 4 in Fig. 1).

many years since the mid-1980s. As Scott's party descended from the cold of the high plateau to near sea level (around days 32–45, or February 1–14, 1912), the temperatures they experienced increased accordingly, as they had anticipated. By February 9, 1912, Scott wrote that "tonight it is wonderfully calm and warm" (ref. 1, p. 565); Wilson similarly reported that "we are all thoroughly enjoying temps of +10°F" (ref. 3, p. 241). Nevertheless, on February 17, one member of the party (Seaman Evans) died. This first death may have been related to a brain injury caused by a fall in a crevasse (ref. 1, p. 573), but complicating factors could have included scurvy, extreme hunger, frostbite, and a cut on the hand (ref. 2, pp. 531–532, 572; ref. 13).

Fig. 3 reveals that the minimum daily temperatures experienced by Scott and his men from about February 10 through 25, 1912, while on the southern end of the Ross Ice Shelf were comparable to the climatological average. But near the end of February (day 57), minimum temperatures fell below −30°F, well below the average values in this region based on modern data. Persistently low daily minimum temperatures were recorded from this point through at least March 12, when the sling thermometer broke. Scott made a few more observations up to March 19, 1912, with his personal thermometer. These were recorded in his journal and are also shown in Fig. 3. With one exception (March 4, 1912), every day of available measurement from February 27 through March 19, 1912, was characterized by daily minimum temperatures below −30°F, as much as 20°F colder than the long-term average daily minima for this region based on automated weather station data for 14 and 15 years (respectively) at two nearby sites as shown. Further, the persistence of the cold temperatures observed in 1912 is unusual. In an average year at station 3 in the modern record, only nine days between February 25 and March 19 display minimum temperatures below −30°F, whereas about 5 days are characterized by much warmer temperatures above −15°F; not one such warm day occurred in 1912. Only 1 of the 15 years of modern data (1988) displays a nearly uninterrupted period of cold daily minima, similar to 1912.

Fig. 4 compares the data of 1912 to the average of daily minimum temperatures for February 25 through March 19 from 1985 to 1999, as recorded by the automated weather stations at 77.91°S, 79.9°S, and 83.13°S (stations 2, 3, and 4, respectively, in Fig. 1); missing data reflect occasional instrument failures. The automated measurements generally track one another well. The more northerly station at 77.91°S is located near the coast and tends to be the warmest of the three locations, whereas the station at 79.9°S frequently displays the coldest conditions; local winds play a major role in controlling temperatures at stations on the Ross Ice Shelf (9). Fig. 4 demonstrates that the period from February 25 to March 19 of 1912 was as cold as or perhaps was the coldest yet recorded near 80°S, 170°E, although it must be acknowledged that the present record is limited to only 16 years. The average minimum temperatures for this time of year in 1912 are about 10°F colder than the average of all of the years of available data from the automated weather station sites at 79.9°S and 83.13°S. Only 1 year in the modern record seems to rival the severity of the temperatures measured in 1912, broadly consistent with Simpson's conclusions that conditions would likely have been milder in roughly 9 out of 10 years. The meteorological data shown in Figs. 3 and 4 therefore reveal that Scott was correct rather than petulant when in his final message to the public he wrote, "... no one in the world would have expected the temperatures . . . which we encountered at this time of year" (ref. 1, p. 606).

Although Fig. 4 demonstrates that there is large interannual variability (a range of ±15°F) in the temperatures near the location where Scott died, secular trends in the same region are quite small (<0.02°F per decade since the late 1950s, see refs. 14 and 15), so that possible long-term climatic changes such as global warming are not the cause of the cold March of 1912. Temperatures at a few Antarctic sites have also been measured for longer periods. Continuous measurements have been carried out since 1903 on the Palmer Peninsula, and sporadic data are available from about 1900 at five more sites, including two on the edges of the Ross Ice Shelf. These observations suggest long-term trends in annually averaged Antarctic temperatures during the 20th century of <2°C, probably closer to 1°C (16). Scott and his party were particularly vulnerable to the large variability of the weather in a specific time of year—late February and March—rather than to the average climatological state and its modest trends.

Among the factors that may contribute to global weather variability in any given year is the El Niño Southern Oscillation (ENSO) that modulates sea surface temperatures in the tropical Pacific region with a periodicity of about 4 years (17). Possible teleconnections between these tropical processes and weather at higher latitudes have been the subject of considerable research (17, 18). Connections between ENSO and Antarctic conditions are speculative because of the relatively short records, and the physical mechanisms for such a link have yet to be firmly established. However, evidence for an ENSO-like (i.e., quasi-quadrennial) signal in the seasonal extent of the sea ice that surrounds Antarctica has been documented in several studies (19–21). One mechanism that has been advanced to couple El Niño to Antarctic sea ice and surface temperature is that of the transfer of heat via the ocean circulation (21). Other authors have stressed the role of katabatic drainage flows from the Antarctic continent in affecting the atmospheric wave structure in the New Zealand sector and, hence, perhaps also the climate on broader scales (22–24). Although a longer record will be needed to ascertain the linkages, if any, of the quasiquadrennial variability in Antarctic weather to ENSO, the evidence suggests that some process does modulate Antarctic climatic variables on a time scale of about 4 years. Observations of the difference in surface pressure measured at Tahiti from that at Darwin, Australia, provide a means of estimating the strength of El Niño. Such data extend back to the latter part of the 19th century and are made publicly available by the Australian Bureau of Meteorology. A statistical study of temperatures on the land surface at Antarctic stations also points toward a quasiquadrennial modulation, with minimum Antarctic surface temperatures of-

ten occurring in the Ross Ice Shelf sector near the El Niño phase of the ENSO cycle (22). It is intriguing to note that 1912 was an El Niño year (25).

The impact of the extreme temperatures shown in Figs. 3 and 4 on Scott and his men in their final month are documented primarily by Scott's own journal, because his companions had ceased writing their diaries by this point (although a few parting letters to family were found). One man (Oates) had been suffering from frostbite throughout much of the return journey (ref. 3, pp. 238–240), and the prolonged cold temperatures of 1912 (as shown in Fig. 3) exacerbated his condition. On March 2, 1912 (day 62), Oates "disclosed his feet, the toes showing very bad indeed, evidently bitten by the late temperatures" (ref. 1, p. 583); Fig. 3 shows that those temperatures were about 20°F colder than average for this location and time of year. His pain and debilitation ultimately drove him out to the snow to die about 2 weeks later, leaving his comrades with the poignant statement: "I am just going outside and may be some time" (ref. 1, p. 592).

In addition to frostbite and lack of rest during nights so cold that sleep in ice-filled reindeer bags was precluded, the cold conditions greatly altered the texture of the snow across which Scott and his party had to drag the sledge that carried their tent, food, and other critical supplies. The low temperatures produced "a thin layer of woolly crystals" and ". . . impossible friction on the runners" (ref. 1, p. 584). The increased drag of the cold snow surface on the sledges therefore also contributed to reducing Scott's northward progress to a crawl. Between March 5 and 14, for example, the team covered only 6–8 miles per day in a region where about 15 miles per day had been achieved on the outbound journey in November 1911 (ref. 1, p. 632). A blizzard began on March 20 (ref. 1, pp. 594–595). This storm ended the attempt to continue marching at a site about 11 geographic miles (12.66 statute miles) from the next depot containing food and fuel (ref. 2, pp. 495–498). Scott's diary is not specific as to the wind speeds during this period, but he emphasized that windy conditions persisted until his final diary entry on March 29. Peak daily winds in excess of 30 km/hour for 7 or more consecutive days have occurred in March during half of the years of available observations (from 1986–1999) by the automated weather station at 79.9°S, with as many as 10 such days being recorded in 3 years. Hence, windy conditions do not appear to be highly unusual for this location and time of year. It is likely that the increased wind raised the temperatures, but Scott ceased recording temperature data when the blizzard began.

The diaries and farewell letters of Scott and his men were recovered from their last camp, at about 79.6°S, along with their meteorological log about 8 months after they died (ref. 2, pp. 495–498).

Concluding Remarks

The observations of the extremely cold temperatures reported by Scott and his companions in March of 1912 do not imply that these frigid conditions alone caused their deaths. Indeed, one man perished before these challenges were encountered and another was already suffering from frostbite, as has been noted. But the unusually cold temperatures that prevailed over an extended period of several weeks substantially contributed to the tribulations faced by Scott and his team during the final stages of their battle for survival. In spite of their plight, the party continued to record the scientific data that provide key information regarding their fate. Those measurements show that they endured minimum temperatures more than 10°F lower than the average that can now be derived from multiple years of automated measurements for the period from February 25 to March 19 near 80°S on the Ross Ice Shelf. On some particular days in March, the daily minimum temperatures in 1912 were more than 20°F colder than the climatological average. These conditions likely contributed to frostbite and extreme fatigue in the men, as well as to the friction of the very cold snow surface that amplified the physical demands of the strenuous task of man-hauling their supplies by sledge, and thereby slowed their progress. Scott and his last two companions died near the 29th of the month (ref. 1, p. 632), after enduring what might be dubbed "the coldest march."

The efforts of many dedicated students, scientists, and support personnel are required to keep the automated weather station network operating in the Antarctic and its results routinely available at uwamrc.ssec.wisc.edu/aws/awsproj.html. The financial support of the National Science Foundation for this network is gratefully acknowledged. Helpful comments by the reviewers of this paper are also appreciated.

1. Scott, R. F. (1914) *Scott's Last Expedition* (Smith, Elder and Company, London), Vol. 1.
2. Cherry-Garrard, A. (1997) *The Worst Journey in the World* (Carroll and Graf, New York), 2nd Ed.
3. Wilson, E. A. (1972) *Diary of the 'Terra Nova' Expedition to the Antarctic 1910–1912* (Blandford Press, London).
4. Simpson, G. C. (1919) *British Antarctic Expedition 1910–1913, Meteorology, Vol. 1, Discussion* (Thacker, Spink, and Co., Calcutta).
5. Huntford, R. F. (1980) *The Last Place on Earth* (Atheneum, New York), pp. 476–478.
6. Preston, D. (1998) *A First Rate Tragedy: Robert Falcon Scott and the Race to the South Pole* (Houghton Mifflin, Boston), p. 219.
7. Schwerdtfeger, W. (1984) *Weather and Climate of the Antarctic* (Elsevier, Amsterdam), pp. 153–156.
8. Wright, C. (1993) in *The Antarctic Diaries of Charles S. Wright*, eds. Bull, C. & Wright, P. F. (Ohio State Univ. Press, Columbus), p. 375.
9. Stearns, C. R., Keller, L. M., Weidner, G. A. & Sievers, M. (1993) *Ant. Res. Ser.* **61**, 1–21.
10. O'Connor, W. P., Bromwich, D. H. & Carrasco, J. F. (1994) *Mon. Weath. Rev.* **122**, 137–150.
11. Simpson, G. C. (1923) *British Antarctic Expedition 1910–1913, Meteorology, Vol. 3, Tables* (Harrison and Sons, London), pp. 618–642.
12. Evans, E. R. G. R. (1922) *South With Scott* (Collins, London), p. 108.
13. Carpenter K. J. (1986) *The History of Scurvy and Vitamin C* (Cambridge Univ. Press, Cambridge), p. 244.
14. Sansom, J. (1989) *J. Clim.* **2,** 1164–1172.
15. Jones, P. D. (1995) *Geophys. Res. Lett.* **22,** 1345–1348.
16. Jones, P. D. (1990) *J. Clim.* **3,** 1193–1203.
17. Allan, R., Lindesay, J. & Parker, D. (1998) *El Niño Southern Oscillation & Climatic Variability* (CSIRO Publishing, Collingwood, Australia).
18. Mo, K. C. & White, G. H. (1985) *Mon. Weath. Rev.* **113,** 22–37.
19. Gloersen, P. (1995) *Nature (London)* **373,** 503–506.
20. White, W. B. & Peterson, R. G. (1995) *Nature (London)* **380,** 699–702.
21. Yuan, X. & Martinson, D. G. (1999) *J. Clim.*, in press.
22. Smith, S. R. & Stearns, C. R. (1993) *J. Geophys. Res.* **98,** 13071–13083.
23. Trenberth, K. E. (1980) *Mon. Weath. Rev.* **108,** 1378–1389.
24. White, W. B. & Cherry, N. J. (1999) *J. Clim.* **12,** 960–976.
25. Zhang, X. G. & Casey, T. M. (1992) *Aust. Met. Mag.* **40,** 211–225.

14.3. Appendix 3 – Data Dragging and Fabrication in Dr Solomon's book *The Coldest March: Scott's Fatal Antarctic Expedition*

> *Unethical behavior in research and scholarship strikes at the heart of the scholarly and educational enterprise. A shared understanding of expectations and responsibilities is, therefore, critical – not only to the quality of the research enterprise but also to the collegial life of this community. Academic misconduct can take many forms, including fabrication or falsification of data, theft of ideas or direct plagiarism, and deliberate interference with the integrity of the work of others.*
>
> Massachusetts Institute of Technology Policies and Procedures[4]

This investigation is based on Dr Susan Solomon's book titled *The Coldest March: Scott's Fatal Antarctic Expedition* published in 2001 by Yale University Press, New Haven, USA.

The purpose of this Appendix is to uncover additional truths to the facts presented in Chapter 4, namely how a great scientific misconduct was committed by Dr Solomon. The misconduct concerns Dr Solomon's data dragging, data omission, data falsification and data fabrication. Each of her figures is presented as originally printed. Each of her figures was "digitized" by me and compared with accurate (correct) data. The precision of digitization is dependent on the quality and resolution of the original figures; however, the maximum digitization error is not more than ±1°F. This error bar is not indicated on my figures as it is about the size of a data point depicted on any given figure. Therefore, the size of circles representing data points must be understood as an error bar.

Dr Solomon's book has 71 figures and the list is presented on pages xi-xiv. Twenty (20) out of 71 are figures depicting meteorological data. Eighteen (18) out of 20 depict actual weather data. All original figures are copyrighted to Yale University Press and are reprinted here with kind permission of Yale University Press, USA.

⋮

Contents of Appendix 3

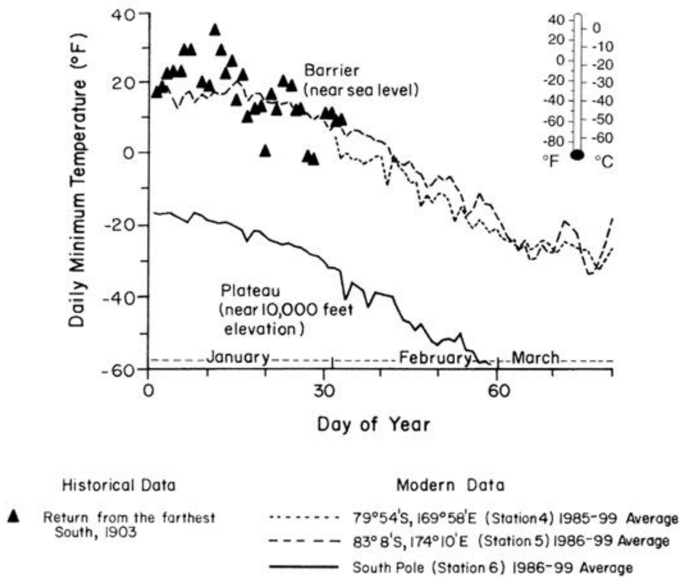
Sources of Scientific Data Used in this Appendix

In this Appendix, I preliminarily used two sources of data. The first is a collection of all meteorological data of the Captain Scott expedition by Dr Simpson. The second source is Dr Solomon's book and respective figures.

1. George Simpson, *Meteorology*, Vol. III, Tables, Harrison and Sons, Ltd., London, 1923. Dr Simpson's volume is freely available at http://archive.org/details/meteorology03simp
2. Susan Solomon, *The Coldest March* published in 2001 by Yale University Press, New Haven, USA.

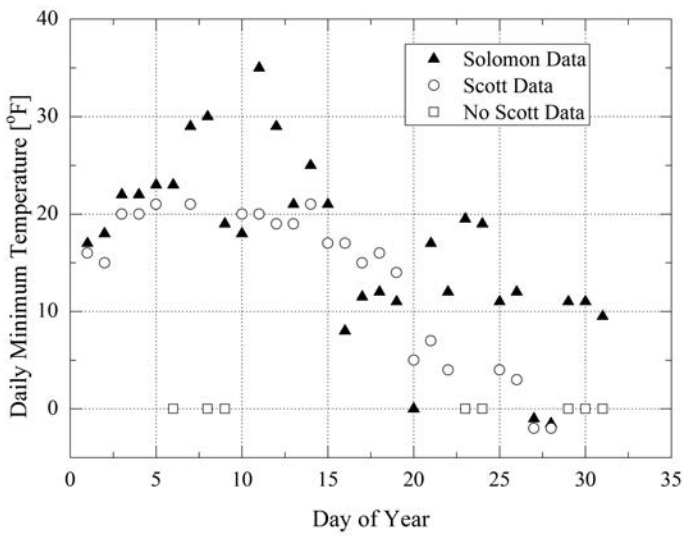
In the case where I did not use Dr Simpson's data I clearly indicate this with a respective reference.

1. Dr Solomon's Figure 9 page 38



Dr Solomon's caption of Figure 9 page 38 – Daily minimum temperatures encountered in 1903, along with contemporary data showing typical conditions for January, February and March.

1.1. Debugged Figure 9-A1



Debugged Figure 9-A1. On this figure, I depicted only part of Dr Solomon's data. I did not include "modern data" as indicated on her figure. Historical Captain Scott data was taken from the *National Antarctic Expedition* 1901–1904. *Meteorology: Part I*[5], *Table XIV. Capt. Scott and Lieut. Shackleton to the South*, *cf.* p. 308.

Comment: A big difference between Captain Scott's actual data and by Dr Solomon's tampered data is observed. Dr Solomon fabricated 31 out of 31 temperature data points. The data points indicated by □ denote cases where no temperature data was recorded by Captain Scott, but Dr Solomon saw fit to invent her own.

2. Dr Solomon's Figure 32 page 151

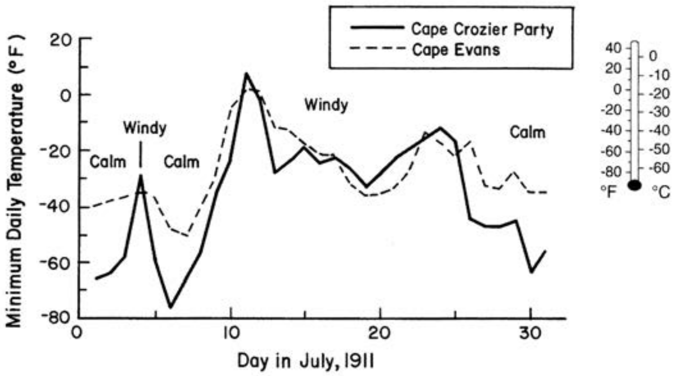
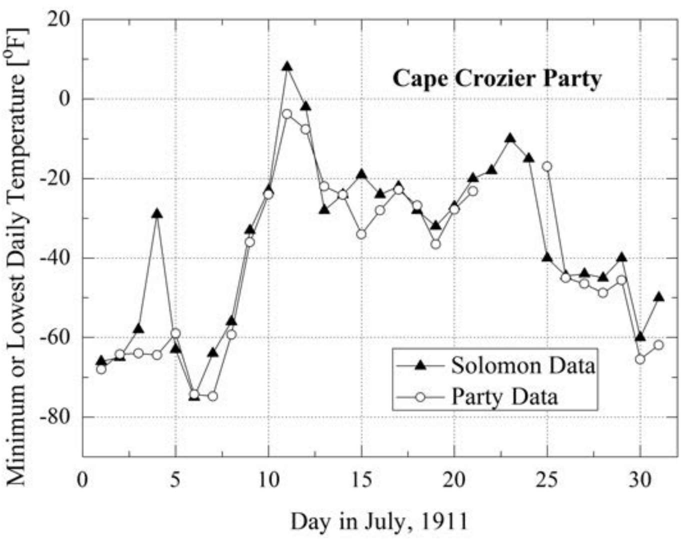


Figure 32. Minimum daily temperatures in July 1911 as documented by the Cape Crozier party, compared with those recorded on the same days at Cape Evans. Windy and calm periods are indicated. As noted by Simpson, the temperature difference between the coast and the Barrier is strongly dependent on the wind, ranging between no difference for very windy periods up to about 20°F to 30°F for very calm days on Windless Bight.

Dr Solomon's Figure 32 page 151 – Minimum daily temperatures in July 1911 taken by the Cape Crozier party, compared with those recorded on the same days at Cape Evans.

2.1. Debugged Figure 32-A1



Debugged Figure 32-A1. Minimum or lowest daily temperatures recorded by the Cape Crozier Party. (○) are Dr Solomon's data and (▲) are the correct data from Dr Simpson.[6] The following temperature data as depicted by Dr Solomon in her Fig. 32 *are not* minimum

daily temperatures but *the lowest* temperatures recorded: July 14th, 17th, 20th, 21st, 24th–26th. Dr Solomon fabricated temperature data for almost every day in July 1911. The most glaring fabrication of temperature data was performed by Dr Solomon for July 4th, 1911. The investigative reader must consult columns "Dry Bulb." and "Remarks" in Dr Simpson's table.

Comment: The most important problem with Dr Solomon's data is that she used her Fig. 32 above to show that the temperature difference between Cape Evans and the Ross Ice Shelf is[7]

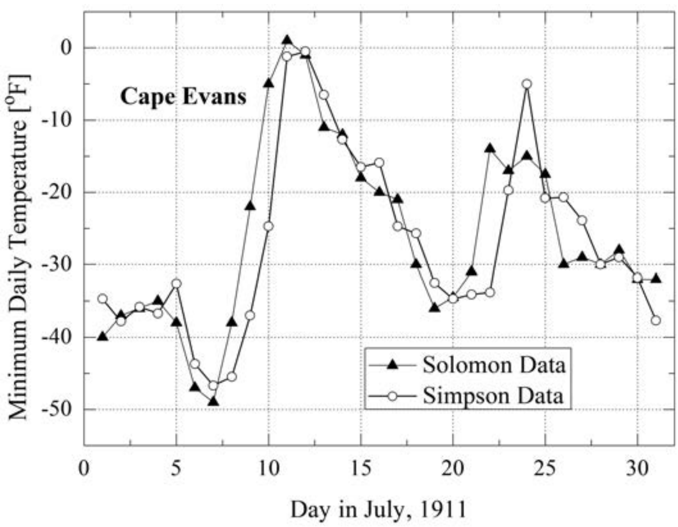
> strongly dependent on the wind, ranging between no difference for very windy periods up to about 20°F to 30°F for very calm days on Windless Bight.

For that reason, Dr Solomon indicated on her figure 32 (above) calm and windy conditions. However, Dr Solomon by indicating a temperature of about –29°F fabricated the Cape Crozier temperature data on July 4th, 1911. She did so to confirm her above-cited thesis. On this day July 4th, Dr Simpson noted[8]

> Min. Temp. −64·4° F. Overcast all day with steady falling snow. Wind force 3 to 4, with occasional gusts from ENE to SE and light breeze from SSE

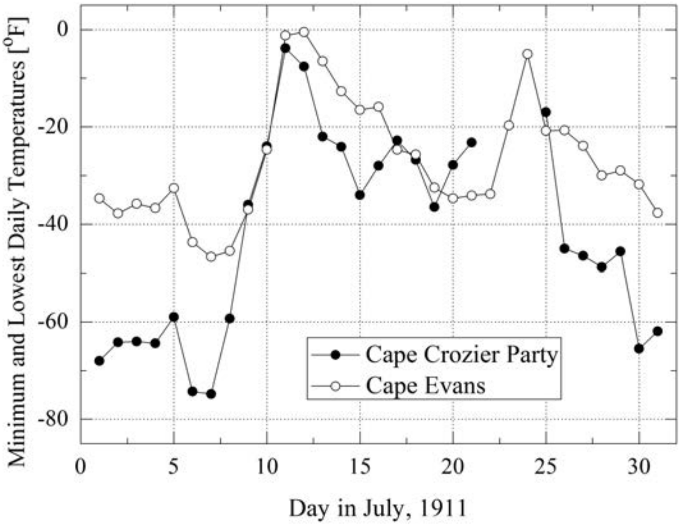
Thus the true minimum temperature recorded on July 4th, 1911 was –64.4°F *and not* –29°F as shown by Dr Solomon on her Fig. 32. Before comparing actual temperature changes between Cape Evans and Windless Bight, or more precisely the Cape Crozier Party data, let me show a comparison of true data and Dr Solomon's attributed to Cape Evans data. The respective data is depicted on Fig. A3. Again one easily notices a significant discrepancy between the true data and Dr Solomon's data as almost all data presented by Dr Solomon was fabricated.

2.2. Debugged Figure 32-A2



Debugged Figure 32-A2. Comparison of minimum daily temperatures as depicted by Dr Solomon (▲) and as recorded at Cape Evans (○) in July 1911.[9]

2.3. Debugged Figure 32-A3



Debugged Figure 32-A3. Comparison of minimum and the lowest daily temperatures recorded at Cape Evans (○) and by the Crozier Party (●) in July 1911.

3. Dr Solomon's Figure 36 page 161

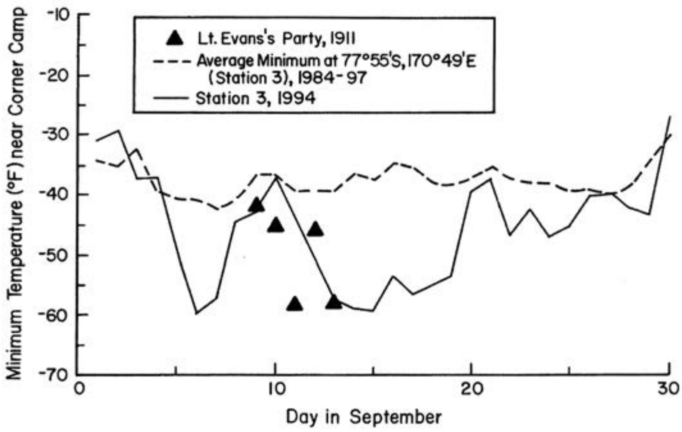


Figure 36. Minimum temperatures in September from the automated weather station at 77°55'S, 170°49'E, near Corner Camp (station 3; see map 2), compared with Lieutenant Evans's 1911 data.

Figure 36 page 161. Minimum temperatures in September from automated weather stations at 77°55′S, 170°49′E. Near Corner Camp (station 3; see map 2), compared with Lieutenant Evans' 1911 data.

Figure 36 on page 161 was presented by Dr Solomon as an illustration of the relationship between the temperatures recorded by Lt Evans on the Barrier and at

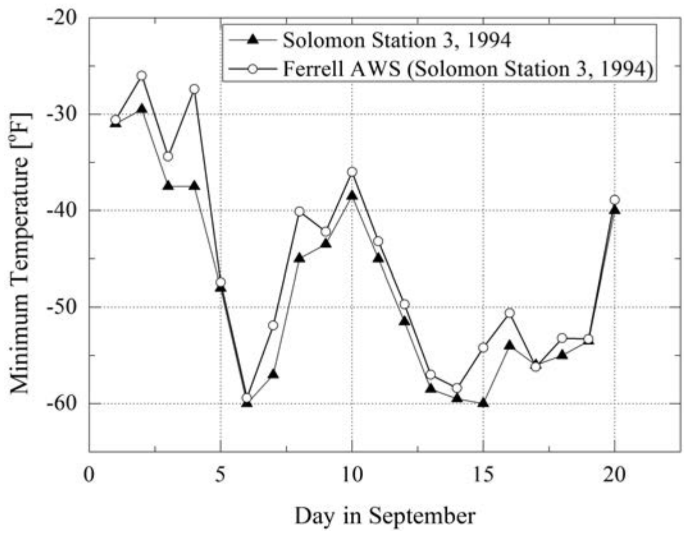
Cape Evans. Yet again, her figure is highly inaccurate and falls into the category of data fabrication, as it depicts only data points selected by Dr Solomon which support her thesis that[10]

> Those minimum temperatures were colder than average for the region near Corner Camp (fig. 36), but within the range of typical variability for the coreless winter's September.

As before, the above argument as well as Fig. 36 is a convolution of half-truths and data fabrication. The data on Dr Solomon's figure concerns temperature records of the Lt Evans party, which is summarized in Dr Simpson's *Table 70. Register of Party from Hut Point to Corner Camp and Back. September 9th–15th, 1911. Observer E. R. G. R. Evans.*[11]

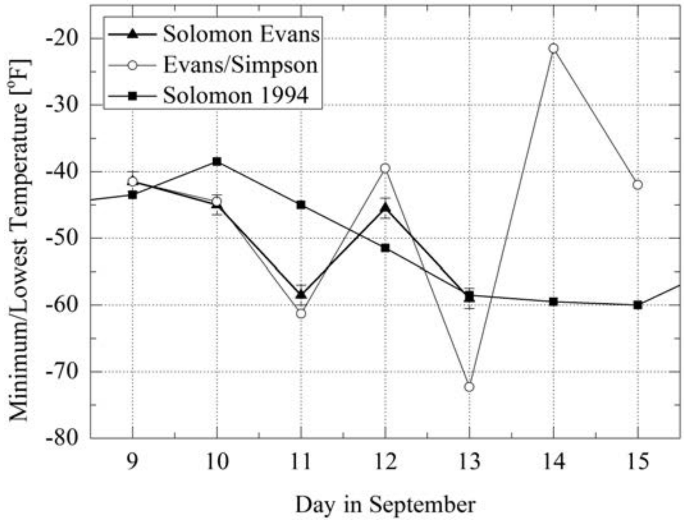
The location of Corner Camp was 77°54′S and 167°17′E and Dr Solomon compares temperature data with an automated weather station named Ferrell (IP-8929) located at 77°55′S and 170°49′E. Thus, the distance between these locations is 67.5 nautical/geographical miles. Dr Solomon does not provide a meteorological rationale for comparison of temperatures at these distant locations. Provided with the observed gradient of temperatures between Hut Point and the Barrier, the study of temperatures in the vicinity of Ross Island is a must for her conclusions, otherwise she is playing with the Cherry Picking fallacy.

3.1. Debugged Figure 36-A1



Debugged Figure 36-A1. Comparison of true minimum temperatures at the Ferrell automated weather station (AWS) (○) with the same minimum temperature data (▲) as given by Dr Solomon. One can see that most of the temperature data was fabricated by Dr Solomon. Note that Dr Solomon's book's station 3 is the Ferrell AWS (see Appendix 1 – Geographical Locations) and the station numbered 3 in Drs Solomon and Stearn's paper in PNAS (section 4.1 and Appendix 2) is the Schwerdtfeger AWS (see Appendix 1 – Geographical Locations).

3.2. Debugged Figure 36-A2



Debugged Figure 36-A2. Comparison of minimum/lowest temperature data for Ferrell AWS (■) as well as the true Lt Evans data (○) and the data fabricated by Dr Solomon (▲).

Comment: From this figure it is evident how Dr Solomon fabricated temperature data to support her thesis that temperatures recorded by Lt Evans "were colder than average for the region near Corner Camp (fig. 36), but within the range of typical variability for the coreless winter's September." Firstly Dr Solomon dragged temperature data for Sep. 11th, 12th, and 13th to be closer to the respective data for the year 1994. Dr Solomon fabricated data by removing Lt Evans' record for 14th and 15th September.

4. Dr Solomon's Figure 43 page 186

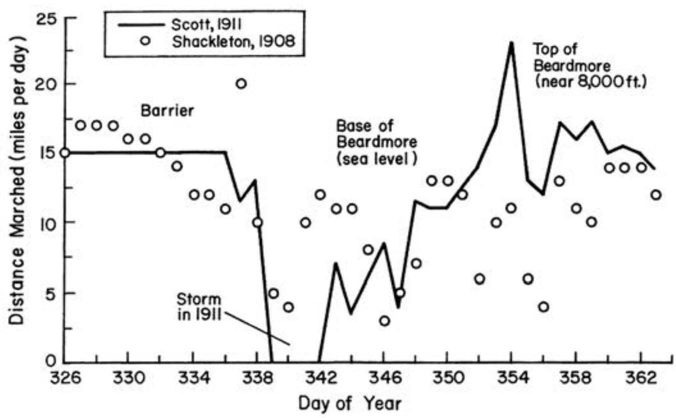
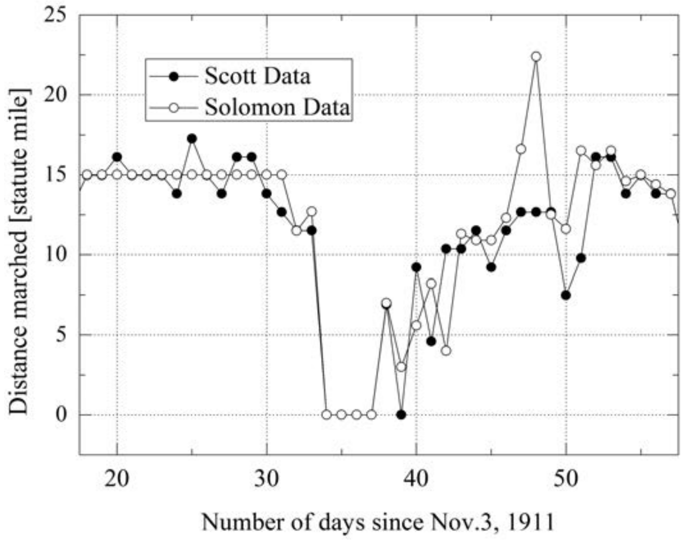


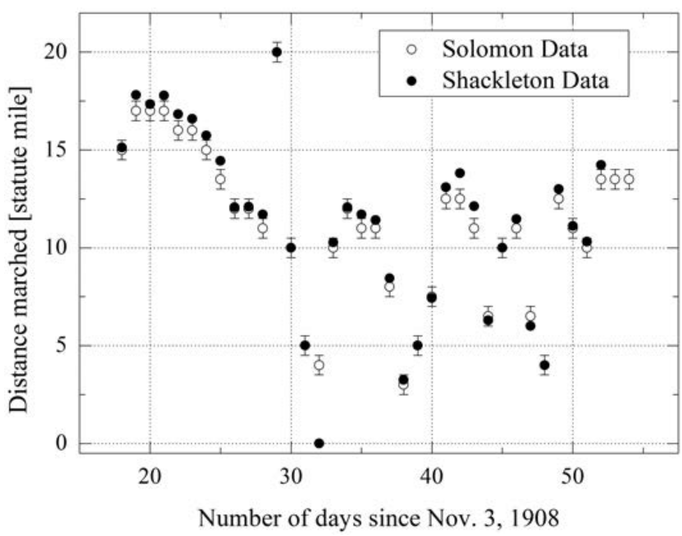
Figure 43. Rates of progress on the Barrier and on the Beardmore glacier by Scott's and Shackleton's expeditions in late November and December of 1911 and 1908, respectively. The storm of early December 1911 drove Scott's progress to zero on those days. Data taken from tables presented in Shackleton's *Heart of the Antarctic* and Scott's *Last Expedition*, vol. 1.

4.1. Debugged Figure 43-A1



Debugged Figure 46-A1. True distances marched by the Captain Scott party are represented by (●) and distances fabricated by Dr Solomon are represented by (○).

4.2. Debugged Figure 43-A2



Debugged Figure 46-A2. True distances marched by Lt Shackleton's party are represented by (●) and distances fabricated by Dr Solomon are represented by (○).

5. Dr Solomon's Figure 49 page 215

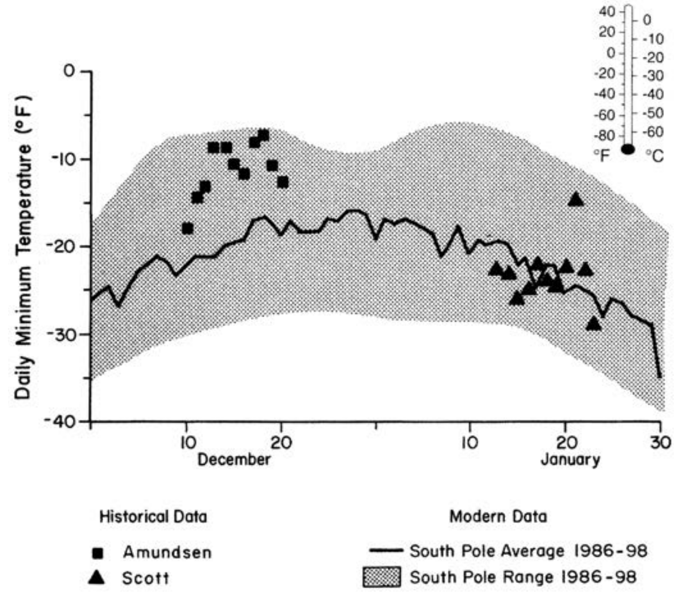
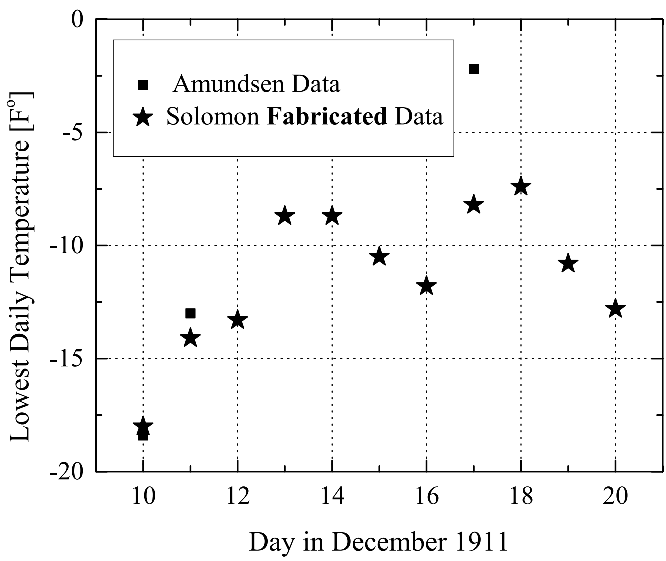


Figure 49. Daily minimum temperatures recorded by Amundsen's and Scott's parties within one degree of latitude of the South Pole, compared to the averages and the ranges recorded by automated weather station data. Amundsen's data happen to lie on the warm edge of the range, while Scott's are generally near the mean, with the exception of one warm day. This difference in the luck of their circumstances, combined with Amundsen's earlier arrival, led to an overall difference of more than ten degrees in the average minimum temperatures experienced by the two groups at the Pole.

5.1. Debugged Figure 49-A1



Debugged Figure 49-A1. Comparison of Captain Amundsen's actual temperature data (■) and Dr Solomon's fabricated data (★) attributed by her to Captain Amundsen.

Table supporting the above Debugged Figure 49-A1. Four data sets are given in the Table. The data are taken from Captain Amundsen's book describing his journey to the Pole, and from the respective data fabricated by Dr Solomon and attributed by her to Captain Amundsen. One should observe that at the time when Dr Solomon prepared her Fig. 49, the *only* data available to her were the data from Captain Amundsen's book. The data from Captain Amundsen's and Bjaaland's diaries became publicly available (including to Dr Solomon) in 2010, when Roland Huntford published these diaries in his book titled *Race for the South Pole: The Expeditions Diaries of Scott and Amundsen*. Thus, Dr Solomon fabricated 8 or 9 data points out of 10 data points.

Date/1911*	Amundsen's[1] Book [°F]	Amundsen's[2] Diary [°F]	Bjaaland's[3] Diary [°F]	Solomon[4] [°F]
Dec. 10th	–18.4	–18.4	–18.4, –18.4	–18
Dec. 11th	–13	–13	–11.2, –14.8, –14,8	–14.1
Dec. 12th	–	–	–10.3, –10,3	–13.3
Dec. 13th	–	–9.4	–9.4, –9.4, –9.4	–8.7
Dec. 14th	–	–	–5.8, –9.4, –5,8	–8.7
Dec. 15th	–	–	–7,6	–10.5
Dec. 16th	–	–13	–5.8	–11.8
Dec. 17th	–2.2	–	–7.6	–8.2
Dec. 18th	–	–2.2	–2.2	–7.4
Dec. 19th	–	–	–11,7, –6.2	–10.8
Dec. 20th	–	–	–11.2, 11.6, 11.6	–12.8

* In here one may notice that Captain Amundsen's diary was 1 day ahead of where it should have been, due to not accounting for crossing over the International Date Line. See Roland Huntford, *Race for the South Pole: The Expedition Diaries of Scott and Amundsen*, Continuum, London, 2010, *cf.* p. 183 and reference 59. Captain Amundsen used corrected dates in his book. But this does not change my conclusion or Dr Solomon's fabrications.

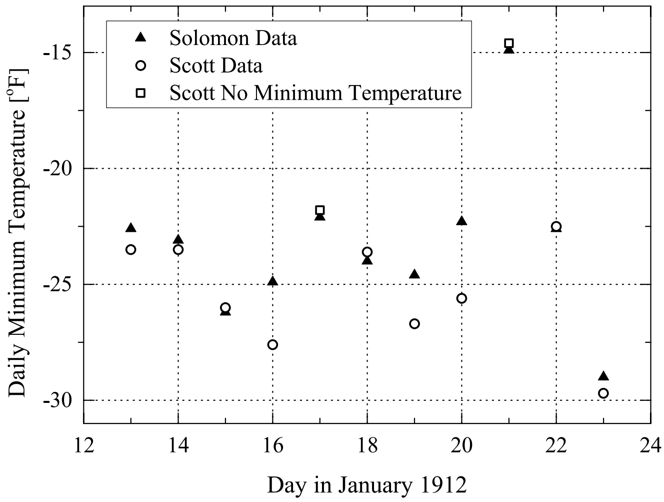
1 Entries from Roald Amundsen, *The South Pole: An Account of the Norwegian Antarctic Expedition in the Fram*, Vol. I and II, John Murray, London, 1912, Vol. II.

2 Roland Huntford, Race for the South Pole: Th*e Expedition Diaries of Scott and Amundsen*, Continuum, London, 2010.

3 *Loc. Cit.*

4 Digitized data from Dr Solomon's Figure 49.

5.2. Debugged Figure 49-A2

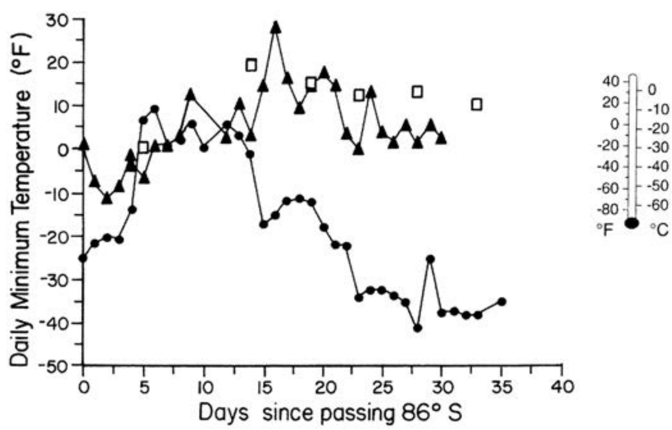


Debugged Figure 49-A2. Comparison of Captain Scott's actual data (○) with the respective data fabricated by Dr Solomon (▲) and attributed to Captain Scott. The data points ▲ are not daily minimum temperatures as denoted by Dr Solomon but lowest recorded temperatures.

Comment: Dr Solomon produced the above figure (Fig. 49) to convince the readers that at the South Pole "Amundsen's data happen to lie on the warm edge of the range, while Scott's are generally near the mean, with the exception of one warm day. This difference in the luck of their circumstances …" (see above Fig. 49 caption). For that reason, Dr Solomon fabricated Captain Scott's data by lowering their values and by increasing values of the data attributed to Captain Amundsen.

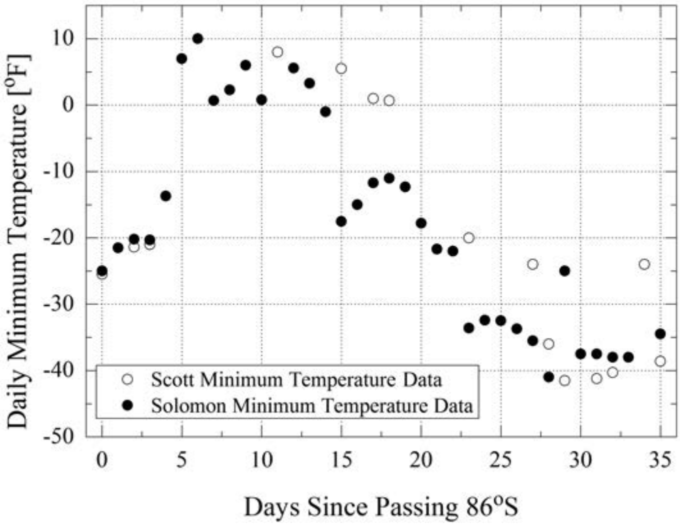
6. Dr Solomon's Figure 53 page 239

Dr Solomon's Fig. 53 contains two merged graphs. One depicts sledging velocities and the second according to Dr Solomon depicts daily minimum temperatures recorded by the first returning, second returning, and polar parties.



Dr Solomon's Figure 53 "… daily minimum temperatures experienced by each party. Data were taken from the tables in Simpson's, *Meteorology*, Vol. III"

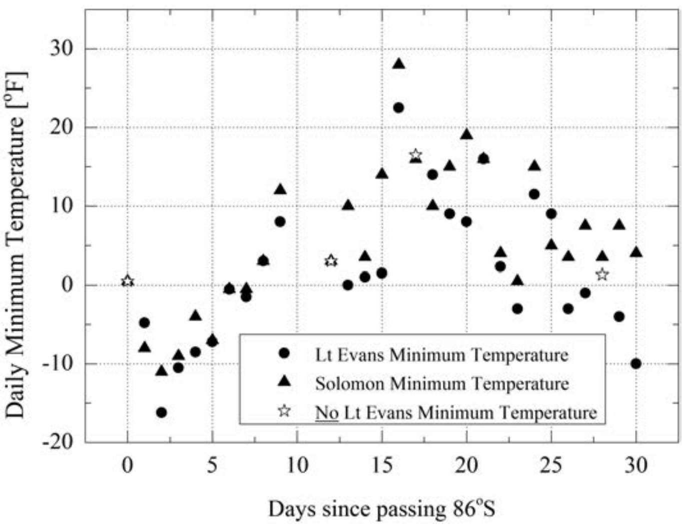
6.1. Debugged Figure 53-A1



Debugged Figure 53-A1. Comparison of Dr Solomon's data attributed to the Captain Scott party (●) with <u>true</u> daily minimum temperatures reported by the Captain Scott party (○).

Comment: With the exception of two daily minimum temperatures from Jan. 30th all remaining data points as given by Dr Solomon (●) are fabricated and not present in Captain Scott's daily minimum temperatures record.

6.2. Debugged Figure 53-A2



Debugged Figure 53-A2. Comparison of Dr Solomon's data attributed to the Second Return Party (▲) with true daily minimum temperatures reported by the Second Return Party (●) indicated on the above figure.

Comment: A significant difference can be observed for almost all daily minimum temperature records between the true Second Return Party data and the minimum temperature data given by Dr Solomon. Again Dr Solomon saw fit to invent data where none existed.

7. Dr Solomon's Figure 62 Page 296

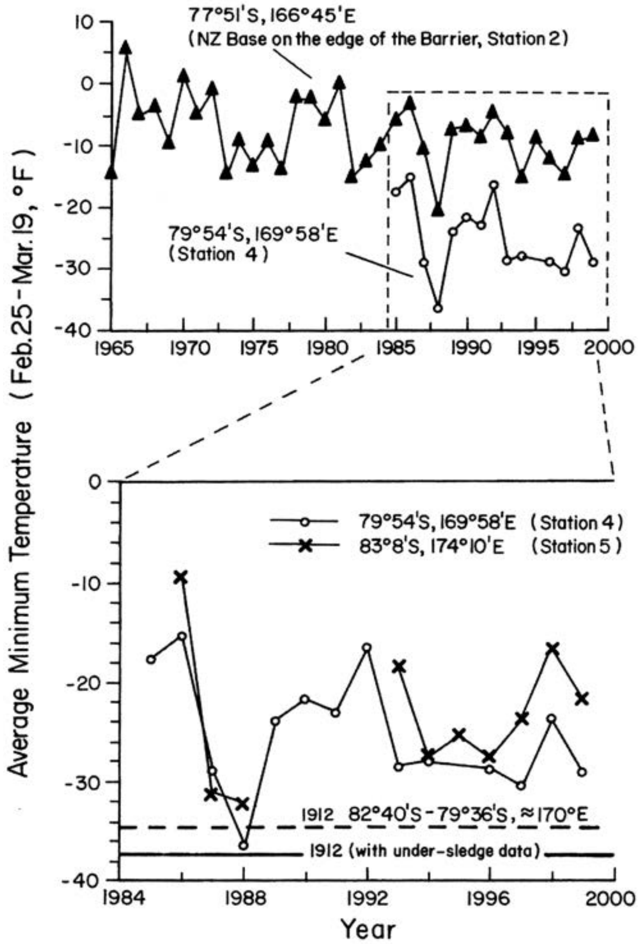
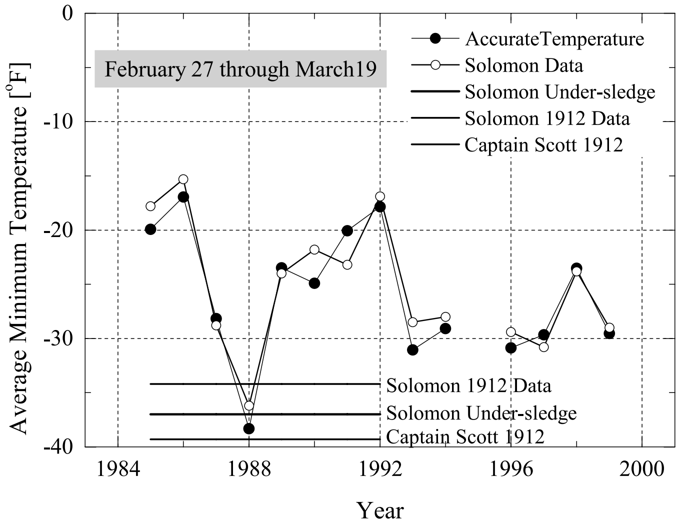


Figure 62 [Original text from Dr Solomon] Average of daily minimum temperatures on the Barrier for the days from February 25 to March 19, comparing data from stations shown in the map 2 with conditions endured by Scott's party in 1912. Temperatures comparable to these observed in 1912 for this period of more than three weeks were observed only in a single year (1988) in all data taken between 1985 and 1999 (bottom panel). Data from the New Zealand base on the edge of the Barrier date back to 1965 and show ups and downs very similar to these seen in the middle of the Barrier (top panel). The top panel therefore suggests that only one year in three and a half decades has been as cold as 1912, confirming that such conditions are extremely unusual.

Dr Solomon's Figure 62 from page 296 is a key figure which was used by her to formulate a fallacious thesis. In here I will point only to Dr Solomon's temperature data fabrication. The logical fallacies are extensively discussed in my book.

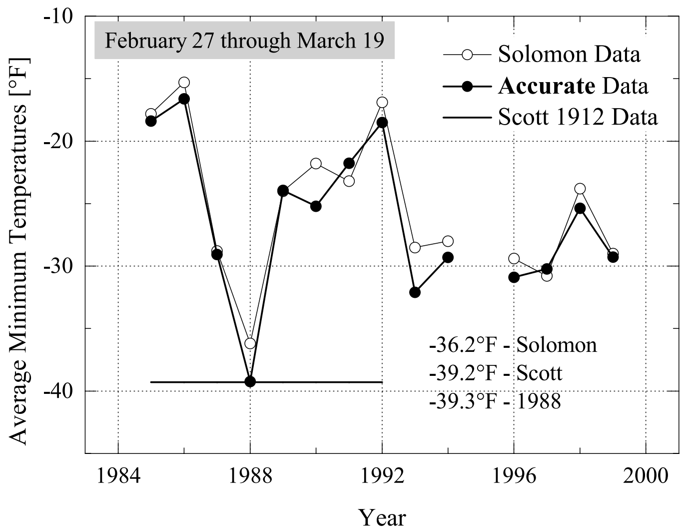
7.1. Debugged Figure 62-A1



Debugged Figure 62-A1. Comparison of true average minimum temperature data (●) with the respective data fabricated by Dr Solomon (○) for the Schwerdtfeger weather station located at the Ross Ice Shelf.

Comment: Dr Solomon not only fabricated temperature data from the Schwerdtfeger weather station but also fabricated Captain Scott's temperature record to fit in with her previous falsification. It is indicated by Dr Solomon's under-sledge and 1912 data which she fabricated to indicate it was in the middle of average minimum temperature in 1988.

7.2. Debugged Figure 62-A2



Debugged Figure 62-A2. Comparison of true average minimum temperature data for the Schwerdtfeger weather station, with Captain Scott's actual data and Dr Solomon's fabricated data.

Summary

In this Appendix, I presented a critical examination of Dr Solomon's fraudulent account of the temperature records of Captain Scott's *Terra Nova Expedition* (1909–1913). Indeed, a comparison of Dr Solomon's data and the true data presented above shows that almost all of Dr Solomon's weather-related data was fabricated.

"Research misconduct means fabrication, falsification, or plagiarism in proposing, performing, or reviewing research, or in reporting research results … It does not include honest error or honest differences in interpretation or judgment of data.
[scientific misconduct is]

1) fabrication, falsification, plagiarism or other serious deviation from accepted practices in proposing, carrying out, or reporting activities funded by NSF [National Science Foundation] or
2) retaliation of any kind against a person who reported or provided information about suspected or alleged misconduct and who has not acted in bad faith."[12]

Taking into account all the above figures, it is evident that Dr Solomon committed gross research misconduct by using data fabrication and falsification to prove her fallacious thesis described in her book *The Coldest March*.

14.4. Appendix 4 – The Whistleblower

To one, science is an exalted goddess;
to another it is a cow which provides him with butter.
Friedrich Schiller

Most of the Western scientific institutions, if not all of them, have worked out *internal* policies for dealing with scientific misconduct. Because of these policies, a fairness-minded person such as a whistleblower may believe that his/her report concerning scientific misconduct by someone will be dealt accordingly and justly. However, this is naïve thinking. Adopted policies related to scientific misconduct have two fundamental faults:

1. These policies disregard the essence of a democratic judicial system – *nemo iudex in causa sua*,
2. These policies are formulated in sufficiently vague langue to allow multiple and thus imprecise interpretations.

The naïve whistleblower may look at the National Science Foundation's procedures of scientific misconduct reporting[13] and find that the good deed can be done using internet form, by phone, fax, snail mail and/or e-mail. In the case of research financially supported by the National Science Foundation, one may choose to report scientific misconduct using e-mail then he/she is advised to contact the e-mail address: oig@nsf.gov. Apparently *oig* stands for Office of the Inspector General, which "is responsible for promoting efficiency and effectiveness in agency programs and for preventing and detecting fraud, waste, and abuse." So far, so good. Now the naïve whistleblower prepares his/hers scientific misconduct report, like say:

1. 14.2 Appendix 2 – Errors and Fallacies in Drs Solomon and Stearns paper *On the Role of the Weather in the Deaths of R. F. Scott and his Companions*

or

2. 14.3 Appendix 3 – Data Dragging and Fabrication in Dr Solomon's book *The Coldest March: Scott's Fatal Antarctic Expedition*

and attaches it to a brief e-mail. One click and the e-mail is sent. In a split second, the oig@nsf.gov automated response is in the naïve whistleblower's inbox with the clearly spelled subject line: "Re: NSF OIG has received your submission. Thank you." The prompt response of the Office of the Inspector General reassures the naïve whistleblower that because "Our office is staffed with auditors, investigators, attorneys, scientists, and other specialists," their report of scientific misconduct will be dealt with accordingly.

Time is passing. Since the NSF does not specify the time frame of dealing with submitted matter, the naïve whistleblower waits, and waits, and waits. After several months, the naïve whistleblower writes a short e-mail with a question related to submission of his/hers original report and sends it to the Office of the Inspector General at oig@nsf.gov. And again a prompt response appears at his/hers computer "Re: NSF OIG has received your submission. Thank you." The naïve whistleblower may get the suspicion that he/she is corresponding with a machine and not a human. However, with his/her justifiable doubts that NSF is innocent until proven guilty, he/she waits. Not being particularly dogged about their report, the naïve whistleblower realizes that already one year is gone and no response received from the Office of the Inspector General.

The very naïve whistleblower one more time resends his/her e-mail to the Office Inspector General, and again the prompt response bounces back: "Re: NSF OIG has received your submission. Thank you."

The naïve whistleblower realizes that he/she has run into an impregnable wall with the National Science Foundation. With his/her strong belief that the truth must prevail, he/she turns to people closer to the culprit's academic entourage with the hope of resolving the issue of scientific misconduct. At that time in late 2012, Dr Solomon was the Ellen Swallow Richards Professor of Atmospheric Chemistry & Climate Science at Department of Earth, Atmospheric, and Planetary Sciences (EAPS), at the Massachusetts Institute of Technology, USA. In a customary way on Apr. 9th, 2012, Dr Solomon presented herself to MIT's public during the EAPS Author Night.[14] Her lecture was chaired by Rob van der Hilst, Department Head and Schlumberg Professor of Earth Sciences, and advertised in the following way[15]

> Presenting to a full auditorium, Susan brings a scientific perspective to understanding the men of the expedition, their staggering struggle, and the reasons for their deaths. Drawing on extensive meteorological data and on her own personal [*sic*] knowledge of the Antarctic, she depicts in detail the sights, sounds, legends, and ferocious weather of this singular place. Susan reaches the startling conclusion that Scott's polar party was struck down by exceptionally frigid weather – a rare misfortune that thwarted the men's meticulous predictions [*sic*] of what to expect [*sic*].

Since I was not present at this lecture, it appears to me that even at such a distinguished academic institution like MIT, the fallacious presentation of Dr Solomon

went unnoticed and "exceptionally frigid weather … thwarted the men's meticulous predictions of what to expect". Captain Scott and Dr Simpson's "meticulous predictions" of the weather at least 4 months ahead from their departure from Cape Evans did not exist, and could not be formulated even today.

After reading MIT's procedures for dealing with academic misconduct in research and scholarship,[16] I submitted my report (Appendix 3 – Data Dragging and Fabrication in Dr Solomon book The Coldest March: Scott's Fatal Antarctic Expedition) to Department Head of EAPS Dr Rob van der Hilst. Here is our e-mail exchange.

E-mail #1: KS (Krzysztof Sienicki) e-mail to VDH (van der Hilst) (Friday, October 19, 2012, 4:37 PM)

> Dear Dr van der Hilst, please find attached to this e-mail my Report on Dr Susan Solomon's Fraudulent Scientific Data Fabrication and Falsification Related to Captain Scott's Expedition to Antarctic 1909–1913.
> This Report is based on Dr Susan Solomon's book entitled The Coldest March published in 2001 by Yale University Press, New Haven.
> A supplementary report on Dr Susan Solomon's fraudulent paper published in Proceedings of National Academy of Science 96(1999)13012–13016 and entitled "On the role of the weather in the deaths of R. F. Scott and his companions" is submitted to the PNAS office.
> Dr Susan Solomon is currently employed at MIT's Department of Earth, Atmospheric and Planetary Sciences.
> The report is submitted to your attention and reaction according to MIT's Department of Earth, Atmospheric and Planetary Sciences (EAPS) policies.
> I would appreciate if you could confirm this e-mail. For additional questions and/or clarifications related to Dr Solomon's data fabrication do not hesitate to e-mail me …
> I would appreciate if you could keep me posted about the matters related to my Report.

E-mail #2: KS e-mail to VDH (Tuesday, Nov. 27, 2012, 10:10 AM)

> Dear Dr van der Hilst, since almost 6 weeks have passed, would you please sent me a word of update in regards to Dr Solomon's Fraudulent Scientific Data Fabrication.

E-mail #3: VDH e-mail to KS (Tue, Nov 27, 2012 at 8:28 PM Nov 27, 2012)

> Dear Dr Sienicki, I am writing this message to inform you that I have read your report on Dr Solomon's work and that I see no evidence in support of the alleged fraudulent activities by Dr Solomon. In case of a genuine scientific dispute about data, instead of making accusations of fraud I suggest one either contacts the author to ask for clarification or publish one's own findings so that readers can respond. Sincerely, Robert D. van der Hilst, Head, EAP

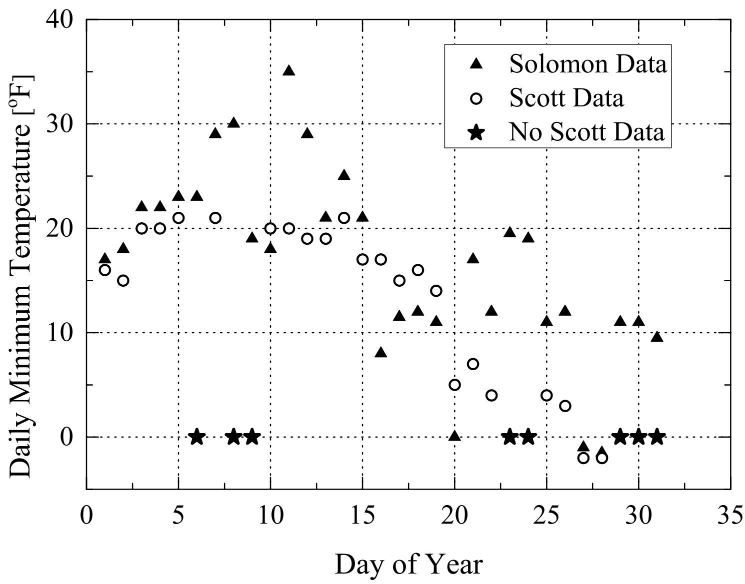
E-mail # 4: KS e-mail to VDH

Dear Dr van der Hilst, I wish to appeal your decision on the grounds listed in attached letter PDF file. Yours sincerely, Dr Kris Sienicki.

[PDF/MS Word file attached to the e-mail]

November 28, 2012

Dear Dr van der Hilst, I admit that the way you responded to my *Report* about Dr Solomon's *Fraudulent Scientific Data Fabrication* comes to me, a whistleblower, with a great surprise. I wish to appeal your decision on the following grounds.
Firstly: From your decision e-mail I conclude that you misunderstood my report which is not about a "genuine scientific dispute about data".
The only set of data in my Report is set of temperature data measured 100 years ago by members of Captain Scott's party and collected in Dr Simpson book (Tables) some 80 years ago. We are dealing here with one set of data, Captain Scott's data.
On each figure I present the original Captain Scott data taken from Dr Simpson's tables. On the same figures I also present respective (to Captain Scott) data given by Dr Solomon.
And that is all I am saying in my Report.
Just take the first figure – line 86 Report – which I reproduce here.



From the above figure Dr Solomon's data fabrication is self-evident. Captain Scott data are depicted by •, while fabricated by Dr Solomon data are depicted by ◦. Dr Solomon fabricated 31 out of 31 temperature data points.

Data indicated by ★ indicate where no Captain Scott temperature data was recorded but Dr Solomon saw fit to invent her own. If this is not a data fabrication and falsification, than what is? Is that as you say to me "no evidence"? I am attaching to this e-mail the original Dr Simpson book with Captain Scott's tables. In relation to the above figure you may consult page 629, where true data points ○ (daily minimum temperatures) are given.
Secondly: would you please stop patronizing me by proposing to me to contacting the author – Dr Solomon. Are you suggesting that the victim of a crime (which is everyone who has been fooled by or has had to bear witness to Dr Solomon's misconduct) should contact the offender to clarify his/hers motives? In any case, I have already repeatedly done so, and have never received a reply. In relation to your suggestion and MIT Policies I ask you to consult Dr Solomon to account for her clarification of the data (○) in the above figure.
Thirdly: it is your responsibility according to MIT Policies and Procedures to investigate "Unethical behavior in research and scholarship strikes at the heart of the scholarly and educational enterprise." Therefore saying without giving precise arguments "that I see no evidence in support of the alleged fraudulent activities by Dr Solomon" does not belong to academic standards of arguing cases and issues.

E-mail #5: KS e-mail to VDH (Tuesday, December 11, 2012, 5:29 AM)

Dear Dr van der Hilst, two weeks ago I submitted to you my appeal in regard to your response to my Report on Dr Susan Solomon's Fraud in Scientific Data Fabrication and Falsification. Could you please let me know, how are you proceeding with my appeal.

E-mail #6: VDH e-mail to KS (Tue, Dec 11, 2012, at 5:07 PM Dec 11, 2012)

Dear Dr Sienicki,
With my message of 27 November 2012 I informed you that I see no evidence that supports your allegations of Fraudulent Scientific Data Fabrication by DrDr Solomon, and I have nothing to add to that statement. Sincerely,
Robert D. van der Hilst
Head, Department of Earth, Atmospheric, and Planetary Sciences
Massachusetts Institute of Technology

E-mail #7: KS e-mail to VDH (Tuesday, December 11, 2012, 5:07 PM)

Dear Dr van der Hilst, thank you for your kind response. However, I am not satisfied with it and with your unsupported remark "that I see no evidence". From this I conclude that my presentation of fabricated (Solomon) and true (Scott) data was not transparent and/or easy to understand. Limiting my question to only one (first in my report and attached to this e-mail for your convince) figure would you please tell me how should I re-cast data points to make more transparent and thus more evidential for your judgment. I also submitted to you a Table with fabricated (Solomon) and true (Scott) data.

Would you please tell me how should I rearrange this table to make it more evident? Should I perhaps add third column with a calculated difference between fabricated (Solomon) and true (Scott) temperature data? [insert Solomon Figure 9.opj and Solomon Figure 9]

E-mail #8: VDH e-mail to KS (Wed, Dec 12, 2012, at 3:24 PM)

Dear Dr Sienicki, I think I have been perfectly clear in my earlier responses. If you want to discuss specific cases, I suggest you contact Dr Solomon directly; I am sure she would be happy to explain the differences or refer to the parts in her book or papers where the origin of the data in her graphs is explained.

E-mail #9: KS e-mail to VDH (Wed, Dec 12, 2012, at 6:32 PM)

Dear Dr van der Hilst, thank you for your kind response. However, I am not satisfied with the way you are handling my Report of scientific misconduct by Dr Susan Solomon. By repeating your previous suggestion that I should directly contact Dr Solomon you simply ignore my e-mail of November 28th, 2012 in which I informed you that "In any case, I have already repeatedly done so [in various forms], and have never received a reply."
I am not pleased by the fact that you are not making the smallest effort to inspect my allegations and concerns. It is indeed disturbing especially if it is associated with the distinguished institute MIT. Since you are the head of EAPS I feel that to simply say in response to my Report that "that I see no evidence" is wrong doing. Not giving an argument for "no evidence" is unfair to the whistleblower, to science and to the general public.
Dr van der Hilst I find your following advice especially disturbing and patronizing "I am sure she would be happy to explain the differences or refer to the parts in her book or papers where the origin of the data in her graphs is explained." Dr Solomon has to explain the differences to you and the public and not to me! To me Dr Solomon fabricated and falsified scientific data. I presented my research on Dr Solomon's case in my Report to you.
I can see your reluctance to look into the matter. It is not nice a call of duty to both of us. But should I just forget about my finding which resulted from re-calculating of some data related to Captain Scott expedition and thus Dr Solomon work? Should we not scrutinize other researcher's results? Should we just forget about reporting the truth?
Let us agree on a minimal plan of looking at the issue. For this purpose I will make say a short version of my Report which will contain only one Dr Solomon figure (the most transparent) and say some short discussion of it. My comments will help you to find a balanced opinion. Then you will ask Dr Solomon to comment on my short version report. I do not think it will do much harm to anyone. After all it is like asking a question during a lecture! If Dr Solomon returns her response I would like to ask you to let read it and comment. Then you may forward my comments to Dr Solomon's attention with request of commenting. On the base of these iterations, you may arrive at an educated judgment.

E-mail #10: KS e-mail to VDH (Tuesday, December 18, 2012, 9:51 AM)

> Dear Dr van der Hilst, it is one week since my last e-mail to you in regard to Dr Solomon's scientific misconduct. Since you are the Head of Department of Earth, Atmospheric and Planetary Sciences, MIT, I would appreciate your response to my e-mail.
> In particular, I would like to know when and how are you planning to implement my suggestion to investigate the minimum plan (one Dr Solomon figure) to make sure that my allegation is true or not.

E-mail #11: VDH e-mail to KS (Tue, Dec 18, 2012, at 4:02 PM)

> Dear Dr Sienicki, I have nothing further to add, and since you are not likely to accept my response I suggest you submit your allegation to the office of MIT's Vice President for Research.
> For me the case is closed.

E-mail # 12: KS e-mail to VDH (Dec 18, 2012, at 11:18 AM)

> Dear Dr van der Hilst, thank you for your response and summarizing statement that for you "the case is close". However, the case was <u>never opened by you</u> and you did make about 30 minutes effort and look at the first figure from my report to find that 31 (all points of this figure) data points presented by Dr Solomon were fabricated. That is your "no evidence" scenario.
> I disagree with your deplorable suggestion that I am "not likely to accept my [your] response". Dear Dr van der Hilst, there was no response from you to my allegations, so how could I accept or refuse it?
> Indeed I am not able to accept your "no evidence" response and that you did not explain how and where you cannot find evidence. I am sorry Dr van der Hilst but by not investigating the case you actively participated in scientific misconduct and promotion of fabricated and falsified data.

E-mail #13: VDH e-mail to KS Tue, Dec 18, 2012, at 5:59 PM

> I said I see no evidence in support of your allegations; I did not say that I did not look into it. I looked at Dr Solomon's graphs and source and description of the data used. From that I conclude that there is no evidence of your claim of data fabrication.

E-mail #14: KS e-mail to VDH (Tue, Dec 18, 2012 at 6:32 PM)

> Dear Dr van der Hilst, thank you very much. Thank you for looking at the data. Did you confirm (establish) that temperature data on the first figure of Dr Solomon's Figure 9 (page 3 in my Report), and Debugged Figure 9-A1 are correct on Dr Solomon's figure? I would appreciate if you say just yes or no.
> The question is: is historical (1903 year) temperature data on Dr Solomon figure 6 depicted accurately(truthfully)?
> Would you please say YES or NO.

Thus ended the e-mail exchange.

The naïve whistleblower could not believe that his case was dismissed based on an *absolutely unspecified* lack of evidence. Indeed, “no evidence” belongs to the standard case of “sweeping the case under the rug,” and MIT procedures define

> An inquiry is initial information gathering and fact finding designed to determine whether or not an allegation deserves further investigation. An investigation is a formal examination and evaluation of all relevant facts to determine if misconduct has occurred.

Did Dr van der Hilst “evaluat[e] all relevant facts”? No. He did not even evaluate *one* data point. He did not want to shoot MIT in the foot by acknowledging that he had welcomed a fraud into MIT’s staff, and so he covered up the case by finding “no evidence”.

In exactly the same way Dr Maria Zuber, who was at the time the Vice President for Research at EAPS, observed “that there is insufficient evidence to warrant initiating an Inquiry pursuant to § 10.1 of MIT’s Policies and Procedures. We consider this matter closed”.

Since the matter has never has been open, it may be closed for Drs van der Hilst and Zuber, but I hope that the present exposure will bring to an end Dr Solomon’s fabrications and her promotion of false science. What a long way MIT has fallen from 2005 and the Luk van Parijs case.[17]

Coda

Here I am, after picoseconds, seconds, minutes, hours, days and nights, weeks, months and finally years of weird and wonderful illuminations. I wonder what was this writing about? The truth? Hardly! "The only thing that could spoil a day was people. People were always the limiters of happiness except for the very few that were as good as spring itself."[1] and I did mention all springs at the beginning of this book. Is it not my final wonder-travel? I am about to move to work on ontological questions of physical measurement. Several hundred papers collected during the years are ready to be read and studied. But I do not intend to work hard. I will not work hard. Life is too short to work. I have a spectacular view from my house's southward facing windows. The viewing terrain is not a result of work or consciously designed, but the result of random and by chance rising of Earth's crust. But how beautiful. It this possible that something arising randomly can be as beautiful as something highly organized?

Ever since I read a very long time ago a novel by Brian W. Aldiss titled *Non-Stop*[2] I had somehow shared my existence and journey with a Roy Complain; this novel's protagonist. One day, Roy is persuaded by another character, his tribe priest Marapper, to venture into unexplored corridors of his world. The priest believed that they lived on board of an unspecified spacecraft roaming in space-time. The priest went even father as to suggest that if Roy and others could find a control room of the spacecraft they could overrun it and …

Though I was not with Roy's expedition, all the way I was trying to get to the control room. It was not a military or governmental control room with the red button. It was a control room in the intellectual pantheon of science; an ultimate control room. However, the maze of corridors was too great and my intellectual powers too small and limited. Too frequently I roamed into *cul-de-sac* corridors. Too frequently I was Newton's "like a boy playing".[3]

But, if miraculously I was able to get to this room, could I find like Roy did, that in the control room all controls setting the mechanisms have been destroyed? The laws of nature were not changeable. Ones in motion remained unchangeable. The spacecraft, though possessing infinite minute variations, was a finite machine, computer-like. That would confirm an anthropic notion[4] that the spacecraft and its inhabitants are special constructions resulting from the laws set in the control room. Not without reason, as observed in this book, the natural sledge dog trotting velocity is *fine tuned* to man's natural surface skiing velocity.

The spacecraft control room might have, if the laws permit, a bull's eye (the black-hole) to provide an insight (drive thru) into other worlds, many-worlds. But

that might be Russell's Chicken observational evidence that because our spacecraft exists, the other or different spacecraft might be present. Yet again it is the Cherry Picking fallacy. Provided that one believes in the linearity of micro-world, one inevitably may fall into the many-world interpretation of events and alternative histories. Besides, how to distinguish history from alternative history? Only by spraying *Ubik* on pages of *The Man in the High Castle*, one – most probably Philip K. Dick – could tell.

Though he could be wrong too, as in the case of his letter to the FBI[5] that Stanisław Lem, whom I cited several times in this book, was a Polish communist provocateur behind "a faceless group in Kraków, Poland" under a fictitious name (like Nicolas Bourbaki I presume) and was producing intellectually and voluminously diverse books to take control of the public.

However, these crazy quantum *theoretical* phenomena do not function in my spacecraft and its path through space and time. At a given split of time, all passengers *collectively* take actions and move in the space-time of the spacecraft's corridors.

I think that we and the physical world are functioning between the limits (boundaries, domains) encircled by today's knowledge. In the hard middle. We are not computers nor intelligently designed. We are not deterministic or free-willed. Today's science, scientific worldview, knocks to the doors of truth as a sop, but only occasionally finds it's barely open to stick a nose in and marvel about.

Mathematics and thus physics are lifeless, not only due to its Cartesian mind and body duality, but for the entire lack of constructor and novelty in physics. Some 71 years ago, Dr Schrödinger in a small book titled *What is Life?* and based on his lectures delivered at the Dublin Institute for Advanced Studies observed that

> … living matter, while not eluding the "laws of physics" as established up to date, is likely to involve "other laws of physics" hitherto unknown, which, however, once they have been revealed, will form just as integral a part of science as the former.

From this time, a tremendous progress in all sciences was made, but *not an inch* toward Dr Schrödinger's dream. Physics with its all equations and notions remain lifeless and unable to self-construct even the most simple molecular systems observed in nature. Dr Schrödinger's book was cited 5027 times in various articles and books. What does it mean? At least, more than five thousand people observed a question for many years and no one was able to make a first step in the right direction. It is inconceivable to think that these people have had time to lollygag the issue.

My strong belief is that all the crises and limits of current physics are due to the language which physicists use in their studies. Obviously, this language is not English or Polish, *it is* mathematics. Mathematics as we know it is the language of physics. Mathematicians and especially pure ones do not care about the real world. What counts for are axioms, rules, theorems, *etc*. In short, classical mathematicians deal with "there exists" interpretations. However, constructive mathematicians are concerned with "we can construct" mathematics.[6] These are entirely and fundamentally different approaches.

If constructive mathematics is used to formulate physical theories, it may result in a "we can construct" physical description of the world-view, instead of today's "there exists" interpretations of the world. In a way, Captain Scott during the *Terra Nova*

Expedition used “today’s” methods, on the contrary to Captain Amundsen’s “we can construct” approach.

But it may be not the case, and the presence of an omnipotent constructor is essential. After all, infinitely complex corridors are real (provided that I ignore George Berkeley) and all rivets were somehow hammered into the starship’s construction, not to mention inhabitants. All points to the conclusion that from the first hydrogen atom, the process of changing and creating by intelligent agents was embedded (eminent). We know the unscientific principle of the Darwinian hypothesis – survival of the fittest. But before the fittest organic world could find its path, an inorganic world was undergoing structural and functional change, ending with *Origin of Species*. Thus the origin of origins was a hydrogen atom. And going one step down with reductionism, one gets to the Big Bang hypothesis and even more elementary particles, which evidently were embedded with emergence of intelligent agents and human chauvinism.

Quis custodiet ipsos custodes? Ignoramus et ignorabimus.

Interview

One of the first books which inspired me by its content and presentation was Galileo Galilei's treatise *The Dialogue Concerning the Two Chief World Systems* (*Dialogo sopra i due massimi sistemi del mondo*) published in 1632. I read this book as a teenager some 340 years after its original publication. The book was titled *Dialog o Dwóch Najważniejszych Układach Świata: Ptolemeuszowym i Kopernikowym*. It presented a discussion comparing the Copernican world view with the traditional Ptolemaic world view. To advance his point, Galileo introduced two philosophers and one layman discussing the topic. I will advance my arguments in somewhat similar fashion.

Dramatis personæ:
EXPOSITOR, trying to present and clarify the main points of the book.
INTERLOCUTOR, skeptical but constructive.

INTERLOCUTOR (INT hereafter): Hello *Expositor*, I'm really happy that we have found a little time to talk together. I read your book carefully. In a number of instances in your book, you are making reference to the "investigative reader" who has his/hers own observations and deductions about Captain Scott and his *Terra Nova Expedition*.

EXPOSITOR (EXP hereafter): Hello *Interlocutor* it's good to have you along. Indeed, a great many times you have proved to be the most investigative and challenging reader of my work.

INT: It was quite enjoyable to follow your writing and to see how the Captain Scott story unfolded in each chapter.

EXP: Indeed, I was surprised by the results of my research and work on Captain Scott. It was an interesting and telling experience. My previous experience was a lifetime spent in theoretical physics work, though in my youth as an assistant at the Technical University of Gdańsk in Poland I was constructing machines from scrap which were capable of capturing and counting single photons of light.

INT: What surprised you while working on a history of Captain Scott's last expedition?

EXP: One of the marvels of working with scientific tools is that by using these tools, one can be certain that "there" is a solution to an originally posted question.

Sometimes, even without a question and just using these tools, one can arrive at significant and unknown previously results which contribute to science. It turns out that it doesn't matter from which point you start it, you will get to the same end. And even more strange is that upon reaching the end, one sees that this is only a temporary end. This state was very finely described by Isaac Newton: "I do not know what I may appear to the world, but to myself I seem to have been only like a boy playing on the sea-shore, and diverting myself in now and then finding a smoother pebble or a prettier shell than ordinary, whilst the great ocean of truth lay all undiscovered before me."

INT: However, you did not answer my question.

EXP: Indeed, my answer to your question required mentioning Newton and many other people's experiences when working on something. Let me recall my own experience. While working on the main subject of my PhD thesis, I had a side issue on which I was working in the early 80s of the twentieth century. The issue concerned certain bimolecular reactions and its kinetic description. For over five years, I thought I had tried all the available mathematical equations that describe the kinetics of the bimolecular reactions. The more I hoped that a given mathematical way (method) could give the expected result, the more mathematical calculations became complicated, difficult (impossible), and ultimately not giving a strict solution which could be compared with experimental results as a confirmation (or disproof) the underlying theory. So it was until I figured out that all the trouble could be eliminated if instead of doing calculations in the real-time domain, I used the so-called Laplace transform to transform equations into the Laplace-domain where the required calculations were indeed simple and compact.[1]

In the case of Captain Scott and his *Terra Nova Expedition*, all seemed as expected as long as I did not try to "digitize" this expedition and, in particular, Captain Scott's journey to the South Pole. But more and more I was transferring this journey into digits, and more and more its entirely unexpected features become evident. It should be noted that the beginning of the unexpected traits of Captain Scott's journey was somewhere around the time when the party on its way back from the Pole reached the Beardmore Glacier, on or about Feb. 2nd, 1912. Captain Evans (see subsection 12.4.1) reached a similar conclusion without realizing the ramifications, putting the beginning of the end after Jan. 29th, 1912.

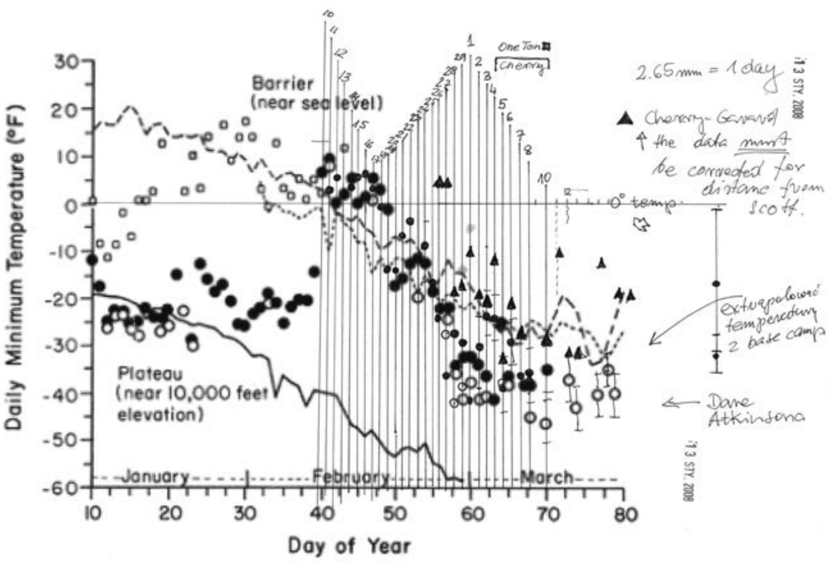
INT: Before asking about these events, let me ask you if you experienced a singular "black swan event" which prompted you to look at Captain Scott journey to the South Pole in a more detailed way?

EXP: Before looking southward, I was well read in Arctic exploration which evidently was much more adventurous and colorful. It was late 1999 or early 2000 when I crossed by chance an article written by Drs Susan Solomon and Charles R. Stearns titled *On the Role of the Weather in the Deaths of R. F. Scott and his Companions* and published in PNAS (see Prolegomenon and section 4.1). The article was using kind of strange terminology, and more importantly I could not believe its logic, which was simply fallacious. The first thing that bothered me from this article was: why is anyone trying to prove that the very low temperatures reported by Captain Scott indeed occurred in the specified period of time, back in late February and early March 1912? After all, Antarctica is a cold place! The second issue was the authors'

attempted to find an answer to this artificial question by fallacious reasoning based on the Cherry Picking Fallacy. The authors absurdly argued that because in the modern record (the year 1988) at a similar location very close to Captain Scott low temperatures were recorded, it meant that the temperatures reported by Captain Scott were true. I was wondering what those authors would conclude if some reason in 1988 the automated weather station was malfunctioning and the authors could not compare it with Captain Scott's record. Would they conclude that Captain Scott falsified his temperature record? Quite probably, the authors would find another year (not 1988) and claim similarity of temperatures.

The issue stayed kind of dormant in my subconsciousness for a good time until I got access *via* the Internet (archive.org) to Dr George Simpson's *Meteorology Vol. III* with the temperature records of Captain Scott's and Cherry-Garrard's parties. Using do-it-yourself methods, I plotted an illustrative figure. The result was indeed intriguing, and I was wondering about the temperature differences between both parties which were at some distance across the Barrier. I even had to make a small note on the side of this figure that Cherry-Garrard's data must be corrected by taking into account the distance between the parties. In the next step, I plotted the respective temperature records at the weather stations along Captain Scott's route (Elaine, Schwerdtfeger, *etc.* weather stations) and found out that the minimum daily temperatures on the Barrier remain quite similar regardless of the station's location. Therefore, there was not a reason to assume that the temperatures recorded by either party (Captain Scott and Cherry-Garrard) should show big (substantial) differences.

This simple and surprising observation lead me into the subject, and it was in a way a black swan event which was driving my curiosity.



A scan of my first do-it-yourself drawing of Cherry-Garrard's temperature data superimposed on Captain Scott's temperature data taken from Dr Solomon's book (Fig. 61, cf. p. 293).

INT: So it was from here that you began looking into an analysis method for examining Captain Scott's record?

EXP: It was a process rather than a singular event. I started to make different plots of temperature records available from modern automated weather stations. My first observation was that the changes of daily minimum temperature recorded at McMurdo, Scott Base, Schwerdtfeger and Elaine nicely followed each other. Temperature changes on the Barrier were clearly followed by similar changes at coastal stations. At the same time, a more or less constant difference of about 20°F persisted between the Barrier temperatures and McMurdo/Scott Base (see Fig. 7.2).

INT: Why did you use the daily minimum temperature in your analysis?

EXP: Oh no, I was afraid that you would ask this question. It is a good question, but the answer is a bit complex. Although everyone is accustomed to the word *temperature*, very few people, with the exception of physicists, can provide an accurate answer resulting from a theory that originated from a kinetic theory of gasses and thermodynamics. In here it is sufficient to say that temperature is the degree or intensity of heat present in a substance (say air) or object (say snow). In turn, the kinetic theory explains that the heat is a macroscopic manifestation of motion and interactions of substance or object microscopic constituents (atoms, molecules, photons). The faster these constituents move, the higher the temperature that is recorded.

During a 24h period, measured near-surface air temperature is changing due to the periodicity of Earth's rotation and all other non-periodic factors. This clearly suggests that the temperature recorded at given time and given location is not an independent and identically distributed variable. In such a case, one cannot use traditional statistical analysis, since that assumes that the variable under consideration is independent and identically distributed. For that reason one, with the exception of Drs Solomon and Stearns (see subsection 4.2.3), cannot calculate the standard deviation of recorded temperatures, as it is meaningless.

Out of a daily temperature record, one can easily find the highest and the lowest daily temperature and call them the maximum and minimum daily temperatures, or extreme daily temperatures. These extreme daily temperatures are also non-Gaussian distributed and governed by extreme value theory, which introduces heavy-tailed distributions of extreme values (see section 1.4.). This further confirms that the standard statistical analysis by Dr Solomon was erroneous.

I hope that now you see the difficulties if not impossibility of using standard statistical methods as an approach to Captain Scott's temperature record, which during the South Pole journey consisted of three actual temperature measurements (morning, lunch time, evening) and one minimum night temperature (see Fig. 3.5 and related discussion). Since I was not using whatever statistical approach I could use any temperature recorded by Captain Scott. However, each temperature entry had its drawbacks. The actual daily temperatures were recorded at different times, as the party did not exactly follow morning, lunch and evening time breaks.

Similarly, what Dr Simpson after Captain Scott called the daily minimum temperature was, in reality, nightly minimum temperature, because it was recorded during the party's sleeping. Fig. 3.5 clearly shows that most but not all daily minimum temperatures occur during the night hours.

Due to the method used by me to predict temperatures, actual and minimum daily temperatures may be used. For simplicity and my obvious lack of interest in hard work, I used the daily minimum temperatures. I believe that some improvement of the results can be achieved by adding into the analysis all available temperatures. However, it could be an exercise for its own sake, since the daily minimum temperatures analysis was sufficient to arrive at my conclusions.

INT: Let me ask you again, when you began looking into an analysis method for examining Captain Scott's record?

EXP: I guess that from the very beginning, right after the first plot of Captain Scott's and Cherry-Garrard's temperature data, I was wondering how to get an educated insight into this temperature record. Of course, I read Dr Simpson's Vol. I and his analysis of Captain Scott's temperature record. His figure as depicted in my book on Fig. 3.11 was catching my eye. Especially one point on it, representing a great divergence between Captain Scott's data as compared with the remaining record of temperature differences between the Barrier and Cape Evans data.

No statistical method was possible to use for the above mentioned reasons. However, something else occurred to me. I remembered the early 90s when I become fascinated with artificial neural networks. Back then, I had even published a paper on using the artificial neural network to predict solutions of the Schrödinger equation, which represents a fundamental equation of quantum mechanics.

In the considered case, one can solve the Schrödinger equation analytically and then calculate the expected values. However, by teaching an artificial neural network how to solve this equation, one can get instant solutions from the network. So, the most time consuming portion was the artificial neural network learning process. After that, the network was capable within a split second of getting an answer to what normally would take say a few seconds.

Back in the early 90s, I together with my colleagues professors Leszek Kułak and Aleksander Herman (both at the Technical University of Gdańsk, Poland) were thinking of developing a software application based on neural networks to be used in computational chemistry and/or engineering applications.

INT: What is the biggest advantage of using an artificial neural network?

EXP: Artificial neural networks have been used in countless scientific and technical (practical) applications. In my opinion, the biggest advantage of artificial neural networks is that their development and application are *model free*. This means that the artificial neural network developer is not concerned with a physical model of the underlying problem to be solved. The network crunches the numbers from the input data, and it returns the output data. The only concern during the network training is to teach the network to provide the answer as close as possible to the expected value.

INT: So I suppose that once you got the temperature results back from the artificial neural network, you got suspicious about the wind events and decided to check those?

EXP: Before the numbers started to come out of the artificial neural network, which I nicknamed Scotty, a long and tedious work of designing and testing took place. Every day I was waiting for "Beam me up [to 1912], Scotty". When I was assured that

Scotty based on modern data was performing in the most efficient way, it was a matter of seconds to crunch Captain Scott's data.

I admit, that I was suspicious from the beginning about Captain Scott's account of wind conditions at the end of March 1912. I also recall here my initial observation (early 2000) of wind data falsification by Drs Solomon and Stearns in their PNAS paper (see section 4.1 and Appendix 2).

INT: How did you detect the silent mutiny at Cape Evans?

EXP: For a long time, I was intrigued by Dr Simpson's sudden, early, and entirely unexpected leaving of Cape Evans in March 1912. According to what was accounted in various books, he was recalled. If Captain Scott's expedition was partly, or as some people suggested, chiefly a scientific expedition, what was more important than a continuation of scientific research in Antarctica? That was my preliminary objection. If Captain Scott and the second in command Lt Evans went to the South Pole, who was in charge at Cape Evans/Hut Point? I realized that it was Dr Simpson, supported by quite precisely written orders (instructions) by Captain Scott. To my mind, the only person who could discharge Dr Simpson from his duty was Captain Scott. I also grasped that after Captain Scott's departure from Cape Evans/Hut Point, whatever was happening there disappeared from historical scrutiny and account. From that moment, I started to ask questions about actions at Cape Evans. Gradually, I become convinced that no one at Cape Evans was willing to risk his neck for Captain Scott and his party.

INT: However, you cannot deny that two attempts were undertaken to support Captain Scott.

EXP: Indeed, one cannot deny the journeys of the First and Second Relief Parties. But it was a relief smokescreen. After Lt Evans' return, *all* possible effort should have been directed toward the Captain Scott party's relief. Though scurvy affected Lt Evans, he was not intellectually affected to the degree of not being able to understand the situation and step in and issue orders. At the same time, he had to have been aware of how he was disfavoured by Captain Scott, and thus did not want to end up court martialed for mutiny himself by trying to stop the mutiny. Thus Lt Evans washed his hands and left with Dr Simpson.

In a more detailed way, I described these actions in Chapter 10. During the time, a lot of counterfactuals were formulated by for example Cherry-Garrard and Dr Atkinson. The absolutely ridiculous notion was formulated that Cherry-Garrard could not sledge southward from One Ton Depôt because he could not navigate!

Indeed, for the ordinary reader, it may sound convincing. After all, very few people could claim that. Even between Captain Scott's personnel, few could claim it. But there was no need to navigate according to theodolite measurements and consequent calculations according to a certain algorithm. Cherry-Garrard was only required to follow (sledge by) his compass needle. I am certain that all of the readers of this book, if told to follow the compass needle to get from A to B, would do it with ease.

Cherry-Garrard could not! So who was he?

Ah, I have to mention the argument that Cherry-Garrard was afraid that he could miss Captain Scott's party while sledging south from One Ton Depôt. Such an observation, taken from Pandora's box of excuses, is detached from simple calculations of possible distances between parties (see section 2.3). On the other hand, I am

certain that if the distance was close enough, the dogs would sniff Captain Scott's party anyway.

And finally, Cherry-Garrard pulled out of the box Dmitrii Girev's faking of illness. He would have us believe that Dmitrii was a malingerer, yet in his own book he mentions the important journeys that Dmitrii was subsequently employed in.

Let me also point out here that Cherry-Garrard was selectively using his apparent short-sightedness when he was not willing to do something, otherwise his eyesight was fine.[2]

INT: Did you ever consider seeking the help of "the families of the defamed dead," as Sir Ranulph put it?

EXP: No, I did not. Only one time, because I was obliged, I tried to ask Captain Scott's grandson Mr Falcon Scott for permission to reproduce in my book a tiny part (one line) of Captain Scott's original journal. The permission was denied, as I described in subsection 10.6.2.

INT: When did you realize that Captain Scott's party committed altruistic suicide?

EXP: One more time I have to say that I arrived at this conclusion not at an instant observation, but rather as a long process resulting from digitization of Captain Scott's journey to the South Pole.

At first, I found that Captain Scott falsified temperature and wind data in late February and March 1912. Based on that, I observed in one of my papers that

> Therefore our understanding about the decisive causes of the Main Polar Party deaths must be entirely reassessed. I conclude that their deaths (Scott, Wilson and Bowers) were a matter of choice rather than chance. The choice was made long before there was an actual end of food, fuel and long before the end of physical strength needed to reach imaginary and delusive salvation at One Ton Depôt.

Now, I see that this summary was a bit more than I could unquestionably prove. One could argue that Captain Scott's thermometer was malfunctioning or that while in the tent he could easily overestimate wind velocity. Of course, a critical examination of my results does not tell why thermometer malfunctioning lead to lowering and not increasing of the recorded temperature. Accordingly, why was Captain Scott while in the tent overestimating rather than underestimating wind velocity?

Anyway, I was digging and not long after, step by step, I found several additional falsifications by Captain Scott.

INT: Which of these new findings were in your opinion the most devastating to Captain Scott?

EXP: Well, I would name three issues. I think the most staggering was my finding that despite Captain Scott's continuous complaints about food/fuel shortages, his party was on full rations until Mar. 27th, 1912!

INT: Are you saying until Mar. 27th, 1912?

EXP: Yes!

INT: How was it possible?

EXP: Indeed, the matter is elementary. Captain Scott planned a 144-days journey to and back from the South Pole. According to this time schedule, food/fuel depôts were placed at certain locations. Each depôt on the returning leg was equipped for a returning party of five men (Scott, Wilson, Oates, Bowers and Evans). Therefore, after P. O. Evans' death on Feb. 17^{th}, his rations remained unconsumed. The same happened with Captain Oates' rations after he committed suicide on March 17^{th}. Now, if you add these unconsumed rations you arrive at the conclusion that the party (Scott, Wilson and Bowers) were on full rations until at least March 27^{th}.

INT: You are right, but the remaining party was so food deprived that they consumed these additional rations.

EXP: Good point, but you have to remember that Captain Scott at no instance commented about these additional rations. On the contrary, the party was short on food/fuel according to his journal. And one additional source of food were the pony cutlets along the return route!

INT: Why did Captain Scott dare to assume that this issue would not surface?

EXP: I do not know. I may very well understand that he could rationally assume that it would be impossible for an external and time-lagged observer to figure out his weather falsifications. But, I cannot say that about the food/fuel rations count! I would say, that this issue points out that from time to time Captain Scott was losing his normal behaviour and was acting in an entirely irrational way. It was one of these bad moments when Captain Scott was detached from reality.

INT: And so what he was counting on?

EXP: I presume that he was not counting on anything particular. Let me remind you, if I may, that a similar detachment from reality occurred when Captain Scott learned about Captain Amundsen's plans to divert his expedition and run for the Pole. Captain Scott was besotted. No counter-action was proposed.

INT: Could he change plans for the South Pole assault after learning about Amundsen?

EXP: No definitive answer is possible to your question. However, what bothers me is that Captain Scott did not analyse the issue. He did not arrive at an educated assessment of his possible steps due to Captain Amundsen's challenge. One would argue that Captain Scott's assessment was that in no way he could sledge faster than Captain Amundsen and, therefore, he argued to proceed as planned while additionally stressing commitment to science. If that was the case, then Captain Scott is at fault for not telling his companions that it was unlikely they would reach the Pole before Captain Amundsen.

INT: Such information would be demoralizing to the party.

EXP: I do not think so. All members of Captain Scott's team had the strong motivation of going to Antarctica and to the South Pole. The biggest fault of Captain Scott was that he did not prepare himself and his companions for the real possibility of losing the Pole to Captain Amundsen and his comrades. It is puzzling, especially

when one reads Captain Scott's comments after arriving at the Pole. One wonders if he was *really* thinking that he could sledge faster than Captain Amundsen with his ski experts and dog teams. It appears that he was thinking that he was able to sledge faster than Captain Amundsen, or that fortune would force Captain Amundsen back short of the goal.

If Scott was rightly anticipating being beaten by Captain Amundsen and if he was sharing this possibility with others, then the party's reaction would be different.

INT: What was the second issue on your list?

EXP: The second and third issues are convoluted, so let me comment on them simultaneously. Captain Scott's South Pole journey was base on his time-schedule, a 144-days sledging scheme. According to this plan, the depôts of food/fuel rations were placed at certain locations along planned route. Therefore, if the party sledged slower than expected, then the party could face a food/fuel shortage. If the party was sledging faster than expected, they would have a surplus of rations. In summary, despite possible and expected sledging velocity daily fluctuations, the parties were obliged to maintain an expected *sustained* sledging velocity, at least 10.1 miles/day. Captain Scott was well aware of this issue, and one can find proof of it in his journal until the beginning of February 1912.

INT: At the beginning of February 1912, Captain Scott's party approached the Beardmore Glacier. What else happened?

EXP: From Feb. 2nd the Captain Scott party's sustained sledging velocity was steadily decreasing. Day by day it was dropping down, yet Captain Scott did not express concerns.

INT: If I recall correctly, they had a few good marches after this date.

EXP: Indeed, but I am not speaking about temporary daily sledging velocity changes. I am concerned, on the contrary to Captain Scott, about sustained sledging velocity, which was systematically decreasing from the beginning of February until the end.

INT: What does it tell you?

EXP: I would rather ask: what does it tell us? Because it was absolutely crucial for the party to maintain the sustained sledging velocity of no less than 10.1 miles/day, Captain Scott should have commented on this inability of his team to do so. The reasons for the continuous decrease of sustained sledging velocity may be complex (weather, fatigue, poor state of equipment, clothing, *etc*.), but it could not pass unrecognized as it was a life or death issue.

INT: And when moving forward at all velocity was a prerogative, the party stopped and geologized.

EXP: I would not be so critical about this issue. One day off, especially after closing the Antarctic Plateau stage, should not have harmed Captain Scott and his comrades. On the contrary, the weather was just fine, the demanding stage was just finished, every day the air was getting easier to breathe. A day off sledging would only do them good. It would not influence the sustained sledging velocity, just as the bliz-

zard in December only temporarily affected party performance. What is absolutely incomprehensible to me is that the party dragged these specimens to the very end. To the rational mind, Dr Wilson's drawings of specimens plus a few best-preserved samples would suffice for the curiosity of the scientific community to gain an initial understanding of Antarctica's past.

INT: What do you make out of this?

EXP: Up to the time when Captain Scott approached the Beardmore Glacier on the return leg, his actions and comments in the journal were not always rationally justified (comparing to Lt Shackleton, ordering Lt Bowers to depôt his skis, *etc*.). But as we know the Captain Scott story up to this time, it was a mixture of right and wrong decisions. And the wrong (incorrect) decisions (actions) were just marginal to the overall journey performance and result. However, right from the moment that the party approached the Beardmore Glacier, the party was dogged by a continuous chain of events, which according to Captain Scott killed the party.

INT: So, what was your thesis?

EXP: Well, if I rewind from the end of March back to early February, I clearly see where the party was heading. I clearly see Captain Scott plotting to deceive the public and explorers' relatives. Captain Scott's plan, which he figured during the return leg over the Antarctic Plateau, was to change his journey's paradigm. Captain Scott's objective was to triumph anyway, despite losing the priority at the Pole. That was what he and his companions could give to the British establishment and society: noble disaster. "To strive, to seek, to find, and not to yield." Especially not to yield. This final line from Tennyson's poem *Ulysses* has a certain ambiguity bordering on a tautology. The intention of this final line is surprisingly not clear. What is "not to yield"? Does it mean it is all right to cover up your suicide as heroism if no one detects your deceit? Does it mean that you should return and not yield to the fears you have?

INT: Are you saying that Captain Scott's deceit was to change his journey paradigm and thus appeal to "heroic hearts"?

EXP: Indeed. That is what I tend to think about Captain Scott's decision of not returning from the South Pole journey. That is what he figured out. What was needed was a decor, to make events simple and credible, yet powerful and uncontrollable.

INT: Like severe weather: unpredictable and uncontrollable.

EXP: Yes. But also like devotion to science, or as Captain Scott commented in the last entry in his journal

> Every day we have been ready to start for our depôt 11 miles away, but outside the door of the tent it remains a scene of whirling drift. I do not think we can hope for any better things now. We shall stick it out to the end, but we are getting weaker, of course, and the end cannot be far.

The only requirement for invented action or event was that it should be poignant. Partial or semi-disaster was not appealing. And only a full disaster was welcome and able to create back in Great Britain the notion of victory over all adverse forces and human weakness, like in the lines of *Ulysses*

To sail beyond the sunset, and the baths
Of all the western stars, until I die.
It may be that the gulfs will wash us down:
It may be we shall touch the Happy Isles,
And see the great Achilles, whom we knew.
Tho' much is taken, much abides; and tho'
We are not now that strength which in old days
Moved earth and heaven, that which we are, we are;
One equal temper of heroic hearts,
Made weak by time and fate, but strong in will
To strive, to seek, to find, and not to yield.

INT: (looks thoughtful)

EXP: So that is the answer to your question. It worked out for Captain Scott for more than one hundred years, and it will work for many people in the future.

INT: You do not assume that your book will change the perception of Captain Scott?

EXP: No, I do not think that it will do much. Reason and science are unable to win against a belief which is shared by common and educated people alike. These already opinionated against Captain Scott will say "I expected this all the way," the opposite side will say "ridiculous unfounded accusations". The only hope is with new young readers who may grab this book and look at Captain Scott in a different way.

INT: That is?

EXP: Captain Scott's story is inevitably convoluted with the British society, and particularly Victorian/Edwardian society with its social organization. He was bound to find (assume) his right position within the social structure of British society. Initially he was bound to move within the Royal Navy's ranks. But then with one strike his personal and social destiny changed forever with an encounter on a London street with Sir Clements Markham, the President of the Royal Geographical Society. From that time, June 1899, Captain Scott's social aspirations changed from mere officer to explorer whose life was bound to exemplify the Empire with its values and heroes. When the Empire gave to one, the Empire expected to get something back. Either way, through great exploits and/or through the sacrifice of life, the Empire's expectations of Captain Scott were clear and evident. Thus by this sudden promotion, Captain Scott was a man in an oxymoron trap, a man who willingly lost his own freedom and independence by allegiance to the Empire with its ranks and social privileges. He knew that he had to deliver or he would be crushed by the Empire's dogs, as he for example experienced with empty-handed attacks over Lt Royds' wind measurements.

INT: Then, of course, there are the business leadership authors, who use a Huntford-derived contrast of Captains Amundsen and Scott as an example. You must pose a threat to these people's profits, since your thesis is that Captain Scott's death had nothing to do with bad planning or not meeting their definitions of leadership.

EXP: While wishing them the best, I do not care about "business leadership authors". I do not have much experience with their work. However from what I can gather,

they usually verbally create hype between audiences and drive them (upon request of their bosses) to think that everyone can be a successful leader. Relentless progress. However, and I do not think that the “business leadership authors” would tell their audiences this, there is a price to be paid if you push too hard. This price was paid by Captain Scott and his comrades. They participated in the national frenzy of conquering the South Pole. And when they arrived at the Pole, it became clear that their created hype would backfire on them and their families.

Let me note again what I said before. If the possibility of not reaching the Pole was an option, if the possibility of being second to Captain Amundsen was openly considered, and if both of these issues were belonging to a success story then …

INT: However, your thesis is not only up against Captain Scott’s legacy. You are also up against the legacy of Apsley Cherry-Garrard and his endlessly acclaimed book.

EXP: I suppose, just like the expedition’s safety was up against Cherry-Garrard. The wealth accumulated by his family allowed him to virtually buy his participation in the expedition. He was going to Antarctica for the sake of going there. I distrust Cherry-Garrard entirely. And without going into details, I can tell you that I can’t trust a man who could not follow a compass needle to contribute to the safety of Captain Scott’s party.

It may be the case that Cherry-Garrard was a gifted writer, but exploration was not about who was the better writer. It was about the need for unconditional readiness to sacrifice one’s life for your comrade’s life.

INT: But you are not against Captain Scott?

EXP: I am *not* against Captain Scott. Actually, I do have a high regard for his work in Antarctica. He was able to command a large team of people and reach the South Pole. And though this may sound surprising, I am convinced that he was able to return with his comrades to Cape Evans/Hut Point. But I am equally convinced that he was capable of convincing his comrades to commit altruistic suicide, by not returning from the South Pole journey. This finding places Captain Scott in an entirely different category, if one is to be found. One does not have to look far to find men sacrificing their lives in the battlefields of World War I, as many went voluntarily to these fields. But I do not think any of them had the intention of persuading anyone other than themselves to die with them.

INT: What should Captain Scott have done after his party began returning from the South Pole?

EXP: Lt Shackleton turned back just 100 miles short from the Pole, and his achievement was widely welcomed and appreciated. Why then was Captain Scott assuming that he would face a different and hostile welcome? There were three important differences between these two explorers. First, Lt Shackleton was an outsider and sponsored by private business. On the contrary, as Sir Clements’ protégé who spent a life dealing with people, Captain Scott was an insider prone to attacks. The second difference was the already mentioned hype created around his expedition. The *Terra Nova Expedition* was destined to reach the Pole and it was out of the question to not reach it. The only questions were how to reach the Pole, how many people will reach it, how many flags will be planted, *etc*. Even after learning about Captain Amundsen’s

presence, this pathetic wishful thinking did not change and even got more dramatic as the *Terra Nova Expedition* party was thinking that the Pole belongs to them anyway. The third and final difference is that Lt Shackleton had made a great stride towards the South Pole, which would suffice for the glory of the British Empire. By contrast, Captain Scott had nothing to do but fill in the last small patch of distance left to the South Pole. Not a glorious achievement at all, unless there was priority at the South Pole at the end of the snowy road.

So what could Captain Scott think of arriving at the Pole? He could only think about how to salvage his name and how to turn things around to become what he was destined to be by himself and the Empire.

INT: But how ethical is it to drag your comrades into oblivion for self-preservation? Should he not have tried to find a different way? Should he have had the courage to return?

EXP: Sledging to the South Pole was not casual physical activity: it was a highly risky undertaking and the list of risks was long. Inevitably, all explorers who went south had to consider and somehow accept the possibility of death due to deadly accident, or due to untreated injury or illness. In the "first mode" George Vince perished in 1902, and in the "second mode" P. O. Evans perished in 1912.

However, the "third mode" of deceasing which was considered was suicide, more precisely altruistic suicide. Let me recall for you what Cherry-Garrard commented[3]

> Practically any man who undertakes big polar journeys must face the possibility of having to commit suicide to save his companions, and the difficulty of this must not be overrated, for it is in some ways more desirable to die than to live, if things are bad enough: we got to that stage [*sic*] on the Winter Journey.

But there is a not considered before possibility. That is the option that the explorer for unspecified reasons collapses mentally and does not want to continue his journey. Clearly, that is what Cherry-Garrard says; "we got to that stage [more desirable to die than to live] on the Winter Journey". But they never crossed that fine line, and returned to Cape Evans.

I presume that you understand where my thinking goes. I think a coherent picture is emerging of what happened with Captain Scott's party. Let me remind you that both Dr Wilson and Lt Bowers undeniably declared their unconditional devotion to Captain Scott. Lt Bowers in his letter to Emily Bowers wrote "I am Captain Scott's man and shall stick by him right through." With a similar devotion George Seaver is quoting Dr Wilson "There is nothing that I would not do for him. He is a really good man".

Captain Scott was devastated by arriving second at the Pole. During the return leg over the Plateau, all aspects and consequences of this event crept into Captain Scott's visions of his future. At the beginning of February 1912, Captain Scott got to the stage where it was "more desirable to die than to live". But thanks to British society's attitude towards suicide, he could not simply check out, and an elaborate deceit was begun.

I suspect that until the death of P. O. Evans, and until Dr Wilson, Captain Oates, and Lt Bowers ceased writing their respective diaries, they all shared the belief of

changing Captain Scott's will. After that, they simply could not abandon him, and stayed together to the end.

INT: But that does not answer my question. You are answering what happened, but not what should have been. These men had families to return to, and so many who would be deceived. What happened on the Antarctic Plateau in 1912 was Captain Scott's character failure in being unable to face the consequences of his failure to achieve priority at the South Pole. Even if it was more desirable to die than to live, he still could have made it through his entire return to normal life, like the great hero Henry Erwin.[4]

EXP: Your suggestion sounds convincing for you, for us. However, that is not what happened. It was Captain Scott's decision and Dr Wilson and Lt Bowers, as "Captain Scott's man" stayed with him to the end.

INT: Finally, how do you think historians will view and use your work?

EXP: I do not care about "polar historians" views about my work. I do not expect that for example Dr Solomon after reading my work will withdraw her paper from PNAS and withdraw her book from the Yale University Press. Nor do I expect that she will publicly acknowledge her fabrications and errors. The most that may happen will be ostracism.

For the wider audience, I think that my work will find appreciation on its own terms. For history teachers, it may serve as an example that historical studies are not only a chain of events, but also a chain of digits describing these events.

I recall toward the last century a hype within the physicist community related to the application of physics to the analysis of problems in the economy. Now on its own it is a scientific subject known as *econophysics*. Though it may sound like an overstatement, I hope that besides my findings of Captain Scott's expedition, my work in some way may belong to *historiophysics*: the research field of applying theories and methods originally developed by physicists in order to solve problems in history studies.

INT: Thank you for your answers.

EXP: Thank you for asking. In a few years time, we may talk again.

The End

References

Prolegomenon

(pages xxv through xxxi)

1 *The Barrier Silence*, Edward A. Wilson, *South Polar Times*, 1911.

2 Karl Popper, *The Open Universe: An Argument for Indeterminism*, Rutledge, Cambridge, 1982*, cf.* p. xix.

3 Arthur Conan Doyle, *The Reigate Squires, cf.* p. 138 in *The Memoirs of Sherlock Holmes, George Newnes Limited, London, 1894.* Also known as *The Reigate Puzzle* or *The Reigate Squire.* This particular book was edited and printed by the company of George Newnes who financed C.E. Borchgrevink *Southern Cross Expedition* 1808–1900.

4 St. Augustine, *De Genesi ad Litteram* (*The Literal Meaning of Genesis*), Book II, xviii, 37.

5 Roald Amundsen, *The South Pole: An Account of the Norwegian Antarctic Expedition in the Fram*, John Murray, London, 1912, Vol. I*, cf.* p. 43.

6 *Ibid*., Vol. I, *cf.* p. 45.

7 Ranulph Fiennes, *Captain Scott*, Hodder and Stoughton, London, 2003, *cf.* p. 182.

8 Robert Falcon Scott, *Scott's Last Expedition: Being the Journals of Captain R.F. Scott*, *R.N., C.V.O.*, Vol.1, Dodd, Mead & Company, The University Press, Cambridge, USA, Vol. I, *cf.* p. 130.

9 Robert F. Scott, *Ostatnia Wyprawa Scotta*, Wydawnictwo „Sport i Turystyka", Warszawa, 1960. Altogether 680 pages. It consists of the entire Volume I and selected entries from Vol. II of Captain Scott's journal originally edited by Leonard Huxley and published in 1913. The first translation into Polish was apparently published in 1914 under the editorial supervision of Polish writer Zofia Nałkowska. However, I was unable to trace this publication. In 1922, the first translation into Yiddish was published in Warsaw under title *Di lectenesije* by B. Szimin printing house. "Polish publishers asked many times in the thirties if they might buy the rights, but Cherry [Apsley Cherry-Garrard] refused. Following another feverish request from Warsaw in the summer of 1939, a time when most people might have been inclined to show the Poles sympathy, Cherry told Penguin bleakly, 'I do not think there is much point in its being translated into Polish'." Cited in Sara Wheeler, *Cherry: A Life of Apsley Cherry-Garrard*, Random House, New York, 2002, *cf.* p. 263.

10 Susan Solomon and Charles R. Stearns, *On the Role of the Weather in the Deaths of R. F. Scott and his Companions*, Proc. Natl. Acad. Sci. USA, **96**(1999)13012–13016. http://www.pnas.org/content/96/23/13012.full.pdf

11 Susan Solomon, *The Coldest March: Scott's Fatal Antarctic Expedition*, Yale University Press, New Haven, 2001*, cf.* p. xviii.

12 https://en.wikipedia.org/wiki/Chewbacca_defense

13 Book flap in the first UK edition by Hodder & Stoughton. Ranulph Fiennes, *Captain Scott*, Hodder and Stoughton, London, 2003.

14 https://www.youtube.com/watch?v=fKc6esIi0_U?t=3m16s

15 Seth Lloyd, *Programming the Universe: A Quantum Computer Scientist Takes on the Cosmos*, Vintage, 2007; Vlatko Vedral, *Decoding Reality: The Universe as Quantum Information*, Oxford University Press, Oxford, 2010; Daniele Oriti, *On the Depth of Quantum Space*, http://arxiv.org/abs/1107.4534.

16 George Murray (Ed.), *The Antarctic Manual, for the Use of the Expedition of 1901*, Royal Geographical Society, London, 1901.

17 Clements R. Markham, *The Lands of Silence, a History of Arctic and Antarctic Exploration*, The University Press, Cambridge, 1921, *cf.* p. 453.

18 F. Leopold McClintock, *Arctic Sledge-travelling, cf.* p. 293–304 in George Murray (Ed.), *The Antarctic Manual, for the Use of the Expedition of 1901*, Royal Geographical Society, London, 1901.

19 I will present and discuss related matters in the following chapters.

20 Roald Amundsen, *The South Pole: An Account of the Norwegian Antarctic Expedition in the "Fram," 1910–1912*, John Murray, London, 1912, Vol. I, *cf.* p. x.

21 Nassim Nicholas Taleb, *The Black Swan: The Impact of the Highly Improbable*, Random House, 2007; Didier Sornette, *Dragon-kings, Black Swans, and the Prediction of Crises*, International Journal of Terraspace Science and Engineering **2**(2009)1–18; Joanna Janczura and Rafał Weron, *Black Swans or Dragon Kings? A Simple Test for Eviations from the Power Law*, http://arxiv.org/abs/1102.3712; Tomasz Gubiec, Tomasz R. Werner, Ryszard Kutner, and Didier Sornette, *Super-extreme Event's Influence on a Weierstrass-Mandelbrot Continuous-Time Random Walk*, http://arxiv.org/abs/1011.6472

22 Ernest Shackleton, *South: the Story of Shackleton's Last Expedition*, *1914–1917*, The MacMillan Company, New York, 1920, *cf.* p. 177; Christian Kharif, Efim Pelinovsky and Alexey Slunyaev, *Rogue Waves in the Ocean*, Springer, 2009; Efim Pelinovsky and Christian Kharif (Eds.), *Extreme and Rogue Waves*, Nat. Hazards Earth Syst. Sci. (2010) Special Issue. http://www.nat-hazards-earth-syst-sci.net

Volume I

(pages 1 through 322)

Chapter 1: General Introduction to the Earth's Air Circulation

pages 3 through 66

1 Lewis Fry Richardson, *Weather Prediction by Numerical Process*, Cambridge University Press, Cambridge, 1922, *cf.* p. 66. See also Oliver M. Ashford, *Prophet – or Professor? The Life and Work of Lewis Fry Richardson*, Adam Hilger, Bristol and Boston, 1985; Peter Lynch, *The Emergence of Numerical Weather Prediction: Richardson's Dream*, Cambridge University Press, Cambridge, 2006; J. C. R. Hunt, *Lewis Fry Richardson and His Contributions to Mathematics, Meteorology, and Models of Conflict*, Annu. Rev. Fluid Mech. **30**(1998)xiii–xxxvi.

2 Roald Amundsen, *The South Pole: An Account of the Norwegian Antarctic Expedition in the "Fram" 1910–1912*, John Murray, London, 1912, Vol. I, *cf.* p. x.

3 Brian Dennis, *Einstein: A Life*, John Wiley & Sons, New York, 1996.

4 Einstein initially objected to the probabilistic aspect of quantum mechanics "the idea that God is playing at dice". Later, he changed his ground and focused instead on the point

that the Copenhagen Interpretation leads to what he saw as the abandonment of physical realism.

5 Ernest Nagel, *The Structure of Science*, Harcourt, New York, 1961, *cf.* p. 281–82.

6 Here, I am referring to John Stuart Mill.

7 E. N. Lorenz, *Journal of Atmospheric Sciences* **20**(1963)130–141.

8 James Gleick, *Chaos: Making a New Science*, Viking, New York, 1988, *cf.* p. 30.

9 Ivar Ekeland, *The Broken Dice and Other Mathematical Tales of Chance*, University of Chicago Press, Chicago, 1993; David Ruelle, *Chance and Chaos*, Penguin Books, London, 1993; Peter L. Bernstein, *Against the Gods: The Remarkable Story of Risk*, John Wiley & Sons, New York, 1996.

10 Ilya Prigogine, *The End of Certainty: Time, Chaos, and the New Laws of Nature*, The Free Press, New York, 1997, *cf.* p. 3; see also Ilya Prigogine and Isabelle Stengers, *Order out of Chaos*, Bantam Book, New York, 1984; Per Bak, *How Nature Works: the Science of Self-organized Critically*, Copernicus, Springer-Verlag, New York, 1996; Stuart Kauffman, *At Home in the Universe: The Search for the Laws of Self-Organization and Complexity*, Oxford University Press, Oxford, 1995. However, the overall picture is even more complicated, and "… the many-worlds physicist believes that the state of the particular universe we happen to be in is ‚the result of its past' and is the ‚cause of the future' of all the universes that will branch out from this one. In principle (but not of course in practice) the future states of all these universes could be calculated from the quantum laws and the present state of our own branch. However, it is interesting to note that it is impossible, even in principle, to make the same calculation about the past as this would require knowledge of the state of presently existing branches other than the one we happen to occupy." Taken from Alastair Rae, *Quantum Physics: Illusion or Reality*, Cambridge University Press, Cambridge, 1986. The coincidence of this author's name and the famous Arctic explorer John Rae (Ken McGoogan, *Fatal Passage: The Story of John Rae, the Arctic Hero Time Forgot*, Bantam Books, 2002) is purely coincidental?

11 John D. Barrow and Frank J. Tipler, *The Anthropic Cosmological Principle*, Oxford University Press, Oxford, 1986; Lee Smolin, *The Life of the Cosmos*, Oxford University Press, Oxford, 1997; Michael J. Denton, *Nature's Destiny: How the Laws of Biology Reveal Purpose of the Universe*, The Free Press, New York, 1998.

12 There are many more demons in science: Harvey S. Leff and Andrew F. Rex, *Maxwell's Demon: Entropy, Information, Computing*, Institute of Physics Publishing, Bristol, 1990; Harvey S. Leff and Andrew F. Rex, (Eds.), *Maxwell's Demon 2: Entropy Classical and Quantum Information Computing*, Institute of Physics Publishing, Bristol, 2003; Mark Ridley, *Mendel's Demon: Gene Justice and the Complexity of Life*, Weidenfeld & Nicolson, London, 2000. The US edition has the less informative title *Cooperative Gene*. For some, science by itself is demonic: Michael Shermer, *Why People Believe Weird Things: Pseudoscience, Superstition, and Other Confusions of our Time*, W. H. Freeman And Company, New York, 1997; J. Frank Tipler, *The Physics of Immortality: Modern Cosmology, God and the Resurrection of the Dead*, Doubleday, New York, 1994; John Brockman, *Intelligent Thought: Science versus the Intelligent Design Movement*, Vintage, New York, 2006, J. Frank Tipler, *The Physics of Immortality: Modern Cosmology, God and the Resurrection of the Dead*, Doubleday, New York, 1994.

13 "nothing would be uncertain" is a serious logical fallacy. After all, uncertainty would become a certainty. For a more extensive discussion, look at Ernest Nagel, *The Structure of Science*, Harcourt, New York, 1961, *cf.* p. 281 and the following pages.

14 Vilhelm Bjerknes, *Dynamics Meteorology and Hydrology*, Vol. I & II, The Carnegie Institution of Washington, Washington, 1910. Vilhelm Bjerknes was the son of Carl Anton Bjerknes, who followed René Descartes' idea that no empty space can exist and contrib-

uted a mechanical explanation of gravitation by studying interactions between solid spheres immersed in the aether. For more on this important subject, consult E. T. Whittaker, *Theories of Aether and Electricity: From the Age of Descartes to the Close of Nineteenth Century*, Longmans, Green & Co., London, 1910 (Particularly Chapter IX: *Models of the Aether*) and Hendrik Antoon Lorentz, *Lectures on Theoretical Physics, Vol. I, Aether Theories and Aether Models, Kinetical Problems,* Macmillan and Co., London, 1927. (Mainly Chapters I to IV). For more on Dr Bjerknes' family, see: Dora B. Grimes, *Bjerknes – like Father – like Son*, in *From Beaufort to Bjerknes and Beyond: Critical Perspectives on Observing, Analyzing, and Predicting Weather and Climate: a Collection of Nineteen Essays Evolving from a Conference of the International Commission on History of Meteorology*, Stefan Emeis and Cornelia Lüdecke, (Eds.), Rauner Verlag, Augsburg, 2005. Although V. Bjerknes is mostly recognized for his contributions in meteorology, one should be aware that he also significantly contributed to the foundations of quantum theory. For more, see Max Planck, *The Origin and Development of the Quantum Theory: The Nobel Prize Address*, Clarendon Press, Oxford, 1922, *cf.* p. 5.

15 Vilhelm Bjerknes, *Dynamics Meteorology and Hydrology*, The Carnegie Institution of Washington, Washington, 1910, Vol. II, *cf.* p. 2.

16 *Ibid*., *cf.* p. 8.

17 *Ibid*., *cf.* p. 175.

18 Lewis F. Richardson, *Weather Prediction by Numerical Process*, Cambridge University Press, Cambridge, 1922, *cf.* p. viii.

19 *Ibid*., *cf.* p. 219.

20 *Loc. cit*. Lewis Fry Richardson was an extraordinary scientist. In the preface of his book, he writes "This investigation grew out of a study of finite differences and first took shape in 1911 as the fantasy which is now relegated to Ch. 11/2." In the aforementioned chapter (*cf.* p. 219), he continues "After so much hard reasoning, may one play with a fantasy? Imagine a large hall like a theatre, except that the circles and galleries go right round through the space usually occupied by the stage. The walls of this chamber are painted to form a map of the globe. The ceiling represents the north polar regions, England is in the gallery, the tropics in the upper circle, Australia on the dress circle and the Antarctic in the pit. A myriad of computers are at work upon the weather of the part of the map where each sits, but each computer attends only to one equation or part of an equation. The work of each region is coordinated by an official of higher rank. Numerous little „night signs" display the instantaneous values so that neighbouring computers can read them. Each number is thus displayed in three adjacent zones so as to maintain communication to the North and South on the map. From the floor of the pit a tall pillar rises to half the height of the hall. It carries a large pulpit on its top. In this sits the man in charge of the whole theatre; he is surrounded by several assistants and messengers. One of his duties is to maintain a uniform speed of progress in all parts of the globe. In this respect he is like the conductor of an orchestra in which the instruments are slide-rules and calculating machines. But instead of waving a baton he turns a beam of rosy light upon any region that is running ahead of the rest, and a beam of blue light upon those who are behindhand.

Four senior clerks in the central pulpit are collecting the future weather as fast as it is being computed, and dispatching it by pneumatic carrier to a quiet room. There it will be coded and telephoned to the radio transmitting station.

Messengers carry piles of used computing forms down to a storehouse in the cellar.

In a neighbouring building there is a research department, where they invent improvements. But these is much experimenting on a small scale before any change is made in the complex routine of the computing theatre. In a basement an enthusiast is observing eddies in the liquid lining of a huge spinning bowl, but so far the arithmetic proves the better

way. In another building are all the usual financial, correspondence and administrative offices. Outside are playing fields, houses, mountains and lakes, for it was thought that those who compute the weather should breathe of it freely."

An equally remarkable vision of what now we call the World Wide Web was presented in 1934 by Paul Otlet. His *réseau* or network was a global network of computers that would permit people to search through an unlimited number of interlinked documents. For his original work, see W. Boyd Rayward, *Selected Essays of Paul Otlet*, Elsevier, Amsterdam, 1990. See also http://people.ischool.berkeley.edu/~buckland/otletbib.html.

21 The New York Times, *Military Supercomputer Sets Record*, John Markoff, June 9^{th}, 2008; The *Roadrunner* is capable of 1.026 quadrillion floating-point calculations per second – an unimaginable and demonic figure, but still short of the Laplace's demon's hunger. In 2011, the Lomonosov, a Russian supercomputer outperformed the *Roadrunner*. As of currently, the king of the supercomputer hill is the Tianghe-2. For a biannually updated list of the fastest supercomputers in the world, see http://top500.org/

22 Lewis F. Richardson, *Weather Prediction by Numerical Process*, Cambridge University Press, Cambridge, 1922, *cf.* p. ix.

23 E. Gold, *George Clarke Simpson: 1878–1965*, Biographical Memoirs of Fellows of the Royal Society **11**(1965)157–175.

24 Scott Polar Research Institute MS 1122/1/2; 1.11.1901. Cited in David E. Yelverton, *Antarctica Unveiled: Scott's First Expedition and the Quest for the Unknown Continent*, University Press of Colorado, Boulder, 2000, *cf.* p. 55.

25 George C. Simpson, *British Antarctic Expedition, 1910–1913, Meteorology*, Vol. I, *Discussion* and Vol. II, *Weather Maps and Pressure Curves*, Thacker, Spink, & Co, Calcutta, 1919; George Clarke Simpson, *Meteorology*, Vol. III, *Tables*, Harrison and Sons, Ltd., London, 1923.

26 Immanuel Kant, *Universal Natural History and Theory of the Heavens or An Essay on the Constitution and the Mechanical Origin of the Entire Structure of the Universe Based on Newtonian Principles*, James Maclehose and Sons, Glasgow, 1900, *cf.* p. 159.

27 *Ibid*., *cf.* p. 162.

28 Markus J. Aschwanden, *Self-organized Criticality in Astrophysics*, Springer, 2011 and Markus J. Aschwanden (Ed.), *Self-organized Criticality Systems*, Open Academic Press, Berlin-Warsaw, 2013.

29 Roger Balian, *From Microphysics to Macrophysics*, Springer, Berlin, 1992, *cf.* p. 221.

30 Mario Blumthaler, *Factors, Trends, and Scenarios of UV Radiation in Arctic-Alpine Environments*, in Arctic Alpine Ecosystems and People in a Changing Environment, Jon Børre Ørbæk et al. (Eds.), Springer, 2007. However, 750 light years away from us, there is a recently discovered planet named TrES-2b with 1% albedo! David M. Kipping and David S. Spiegel, *Detection of Visible Light from the Darkest World*, Mon. Not. R. Astron. Soc., Aug. 10^{th}, 2011.

31 G. Hadley, *Concerning the Cause of the General Trade Winds*, Phil. Trans. XXXIX, 1735–36, *cf.* p. 58–60.

32 On the basis of Hadley's statement that *all winds from any one quarter must be compensated by a contrary wind*, I argue that he was describing conservation of linear momentum for the trades. Here, I argue on the contrary to John M. Lewis, *Clarifying the Dynamics of the General Circulation: Phillips's 1956 Experiment*, Bulletin of the American Meteorological Society **79**(1998)39–60.

33 Charles C. Gillispie, *Science and Polity in France: The Revolutionary and Napoleonic Years*, Princeton University Press, Princeton, 2004.

34 René Dugas, *A History of Mechanics*, Courier Dover Publications, New York, 1988, *cf.* p. 377.

35 Francis R. Stephenson, *Historical Eclipses and Earth's Rotation*, Cambridge University Press, Cambridge, 1997.

36 The most spectacular observation of Earth's rotation and Coriolis force was presented by Léon Foucault, who on Jan. 8^{th} 1851 observed the plane of the pendulum's swing rotations. Later in 1851, the so called Foucault Pendulum was suspended with a 28 kg bob and a 67 metre wire from the dome of the Panthéon in Paris where it can be observed today. In the Panthéon, the plane of the Foucault Pendulum swing rotates clockwise 11° per hour, making a full circle in about 32.7 hours. For a more relaxing but equally challenging tactic, the reader may consult Umberto Eco's book *Foucault's Pendulum*.

37 According to Einstein's theory of general relativity, the force of gravity is on the same footing as these fictitious forces.

38 In an interesting turn of events Earth's rotating frame of reference was used to test spooky action at a distance, and it was shown that 2-photon interference fringes frequently reach the level of Bell inequality: D. Salart, A. Baas, C. Branciard, N. Gisin and H. Zbinden, *Testing the Speed of „Spooky" Action at a Distance*, Nature **454**(2008)861–864. For fictitious force in quantum mechanics, see: I. Białnicki-Birula, M. A. Cirone, J. P. Dahl, T. H. Seligman, F. Straub and W. P. Schleich, *Quantum Fictitious Forces*, Fortschritte der Physik **50**(2002)630–635.

39 A. Einstein, *Die Ursache der Mäanderbildung der Flußläufe und des sogenannten Baerschen Gesetzes*, Die Naturwissenschaften, 1926, 11, *cf.* p. 223–224; see also Kurt Gödel, *An Example of a New Type of Cosmological Solutions of Einstein's Field Equations of Gravitation*, Rev. Mod. Phys. **21**(1949)447–450.

40 S. A. Werner and Jean-Louis Staudenmann, *Coriolis Effect of Earth's Rotation on the Quantum Mechanical Phase of the Neutron*, Phys. Rev. Lett. **42**(1979)1103–1106. For the captivating story of aether, see: Edmund T. Whittaker, *A History of the Theories of Aether and Electricity: from the Age of Descartes to the close of the Nineteenth Century*, Longmans, Green & Co., London, 1910; and for modern developments Guido Rizzi and Mateo L. Ruggiero (Eds.), *Relativity in Rotating Frames: Relativistic Physics in Rotating Reference Frames (Fundamental Theories of Physics)*, Springer, Berlin, 2004.

41 William Ferrel, *An Essay on the Winds and the Currents of the Oceans*, Nashville Journal of Medicine and Surgery, vol. XI, no. 4/5, 1856. William Ferrel, *The Motions of Fluids and Solids Relative to the Earth's Surface*, Ivison, Phinney, and Co, New York, 1860; William Ferrel, *A Popular Treatise on the Wind: Comprising the General Motions of the Atmosphere, Monsoons, Cyclones, Tornadoes, Waterspouts, Hail-storms, etc, etc*, MacMillan Co, London, 1890; William Ferrel, Hazen, William, Babcock, *Popular Essays on the Movements of the Atmosphere Office of the Chief Signal Officer*, Washington, 1882.

42 J. Coffin, *The Winds of the Globe: Or the Laws of the Atmospheric Circulation over the Surface of the Earth,* Smithsonian Contribution to Knowledge 268, Vol. 20, Smithsonian Institution, 1875; Alexander J. Woeikof, *Discussion and Analysis of Professor Coffin's Tables and Charts of the Winds of the Globe*, Collins, Philadelphia, 1876.

43 F. M. Maury, *The Physical Geography of The Sea*, Sampson, Low, Son & Co., London, 1859; F. M. Maury, *Physical Geography for Schools and General Readers*, Longman, London, 1864.

44 David E. Cartwright, *Tides: A Scientific History*, Cambridge University Press, Cambridge, 1999.

45 In Ferrel's and modern notation.

46 Charles Tracy, *On the Rotary Action of Storms*, American Journal of Science **XLV(1)** (1843)65–73.

47 *Ibid*., *cf.* p. 66.

48 *Ibid*., *cf.* p. 71.

49 *Loc. cit.*

50 The Norwegian scholar Cato Maximilian Guldberg (1876) in the book *Études sur les Mouvements de l'atmosphère* explained: "Studies on the movements of the atmosphere: during the movement of the air, there are two new forces that are in action: (1) the rotation of earth and the friction between the air molecules; (2) the friction between those molecules and the earth surface. The earth rotation produces itself two forces, the centrifugal one, which coupled to the earth attraction, produces the result g, and the second centrifugal force, identified as a composed centrifugal force. This force, which we will call deviatory [fictitious Coriolis force], is perpendicular to the trajectory of the air particle and directed to the right in the northern hemisphere and to the left in the southern hemisphere." [Translated by Félix de la Poterie-Sienicki]

51 Charles Wilkes, *Theory of the Winds*, Philadelphia, 1856, *cf.* p. 7.

52 Alan Hirshfeld, *Eureka Man: The Life and Legacy of Archimedes*, Walker & Co, 2009; Amelia C. Sparavigna, *The Vitruvius' Tale of Archimedes and the Golden Crown*, http://arxiv.org/abs/1108.2204.

53 A. Andersen, T. Bohr, B. Stenum, J. Juul Rasmussen and B. Lautrup, *Anatomy of a Bathtub Vortex*, Phys. Rev. Lett. **91**(2003)104502.

54 D. Küchemann, *Report on the I.U.T.A.M. Symposium on Concentrated Vortex Motions in Fluids*, J. Fluid Mech. **21**(1965)1–20.

55 H. K. Moffatt, S. Kida and K. Ohkitani, *Stretched Vortices – the Sinews of Turbulence; Large – Reynolds – Number Asymptotic*, J. Fluid Mech. **259**(1994)214–264.

56 O. Turmlitz, *Ein neuerphysikalischer Beweis der Achsendrehung der Erde*, S.B. Akad. Wiss. Wien, Abt. IIa. **117**(1908)819. See also – *Draining in Bathtubs and Toilets* in http://en.wikipedia.org/wiki/Coriolis_effect#cite_note-27

57 A. H. Shapiro, *Buth-tub Vortex*, Nature **196**(1962)1080–1081; A. M. Binnie, *Some Experiments on the Bath-tub Vortex*, J. Mech. Engng Sci. **6**(1964)256–257.

58 L. Trefethen, R. W. Bilger, P. T. Fink, R. E. Luxton and R. I. Tanner, *The Bath-tub Vortex in the Southern Hemisphere*, Nature **207**(1965)1084–1085. The reader (meaning the taxpayer) may wonder why in 1965 up to six Australian scholars performed scholarly enquiries into the question.

59 Winston Cope, *The Bathtub Vortex*, Scientific American **71**(1983)566.

60 Leo Koenigsberger and Frances A. Welby, *Hermann von Helmholtz*, Clarendon Press, Oxford, 1906; Michel Meulders and Laurence Garey, *Helmholtz*, MIT Press, 2010; John G. McKendrick, *Hermann Ludwig Ferdinand von Helmholtz*, BiblioBazaar, 2008; Gregor Schiemann, *Hermann von Helmholtz's Mechanism: the Loss of Certainty: A Study on the Transition from Classical to Modern Philosophy of Nature*, Springer, 2009; David Cahan, *Hermann von Helmholtz and the Foundations of Nineteenth-century Science*, University of California Press, 1993.

61 Jie-Zhi Wu, Hui-Yang Ma and Ming-De Zhou, *Vorticity and Vortex Dynamics*, Springer, 2006, *cf.* p. 3.

62 Albert Einstein, *The Cause of the Formation of Meanders in the Courses of Rivers and of the So-Called Baer's Law*, in Die Naturwissenschaften 14(1926), after http://www-paoc.mit.edu/paoc/papers/PTE000292%20(1).pdf See also http://www.fast.u-psud.fr/~moisy/papers/mpggr_epn03.pdf.

63 A. Pasini and V. Pelino, Phys. Lett. A **275**(2000)435–446; J. B. Ramsey and Z. Zhang, in *Predictability of Complex Dynamical Systems*, Springer, Berlin, 1996; N. A. Phillips, *On the Problem of Initial Data for the Primitive Equations*, Tellus **12**(1960)121–126.

64 http://www.claymath.org/millennium/Navier-Stokes_Equations/

65 Yvette Kosmann-Schwarzbach, *The Noether Theorems: Invariance and Conservation Laws in the Twentieth Century*, Sources and Studies in the *History of Mathematics and Physical*

Sciences. Springer-Verlag, Berlin, 2010; Margaret B. W. Tent, *Emmy Noether: The Mother of Modern Algebra*, A. K. Peters, Wellesley (MA), 2008.

66 A well-posed problem is a problem of which: (1) the solution exists, (2) the solution is unique, (3) the solution depends continuously on the data, in some reasonable spatiotemporal frame.

67 Eberhard Bodenschatz and Michael Eckert, *Prandtl and the Göttingen School*, http://arxiv.org/abs/1107.4729; For a more general account, see Olivier Darrigol, *Worlds of Flow: A History of Hydrodynamics from the Bernoullis to Prandtl*, Oxford University Press, Oxford, 2005.

68 J. R. Garratt, *The Atmospheric Boundary Layer*, Cambridge University Press, Cambridge, 1994, *cf.* p. 1.

69 William H. Hobbs, *The Rôle of the Glacial Anticyclone in the Air Circulation of the Globe*, Proc. Am. Phil. Soc. **LIV(218)**(1915)187–199.

70 Lord Rayleigh, *IX. Further Applications of Bessel's Functions of High Order to the Whispering Gallery and Allied Problems*, Phil. Mag. **27**(1914)100–109. J. Walker, *The Amateur Scientist*, Scientific American **238**(1978)156–161.

71 James Clark Ross, *A Voyage of Discovery and Research in the Southern and Antarctic Regions, During the Years 1839–43*, John Murray, London, 1847, Vol. II, *cf.* p. 384.

72 Fridtjof Nansen, *In Northern Mists: Arctic Exploration in Early Times*, Vol. I and II, W. Heinemann, London, 1911.

73 Fridtjof Nansen (Ed.), *The Norwegian North Polar Expedition, 1893–1896; Scientific Results*, Longmans, London, 1905.

74 *Ibid*., *cf.* p. 577, see also the editorial, *Mohn's Results of Nansen's North Polar Work*, Mon. Weather Rev. September 1905, *cf.* p. 401.

75 *Loc. cit.*, where k is the friction coefficient.

76 *Ibid*., *cf.* p. 606.

77 V. Walfrid Ekman, *On the Influence of the Earth's Rotation on Ocean-currents*, Arch. Math. Astron. Phys. **2**(1905)1–52.

78 Alastair D. Jenkins and John A.T. Bye, *Some Aspects of the Work of V. W. Ekman*, Polar Record **42**(2006)15–22.

79 Adrien, Gerlache de Gomery, *Voyage of the Beliga-Fifteen Months in the Antarctic* (*Voyage de la „Belgica.": Quinze mois dans l'Antarctique*), Hachette, 1902 & Bluntisham Books 1998.

80 Résultats du voyage du S. Y. Belgica en 1897–1898–1899: sous le commandement de A. de Gerlache de Gomery. Rapports scientifiques publiés aux frais du gouvernement belge, sous la direction de la Commission de la Belgica, Vol. III & IV, J. E. Buschmann, Brussels, 1907; Henryk Arctowski, *About Climatical Variations*, New Haven, Hastings-on-Hudson, 1914; *Géographie physique de la région antarctique visitée par l'Expédition de la Belgica: conférence donnée a la société royale belge de geographie,* le 6 décembre 1899, Bruxelles, 1900.

81 Antoni B. Dobrowolski, *Polar Exploration: History and Scientific Achievements*, (in Polish), Warsaw, Lidenfeld, 1914; Antoni B. Dobrowolski, *Diary of Antarctic Expedition (1897–1899),* (in Polish), Ossoliński, Wrocław, 1962.

82 The ship was beset for the winter on Mar. 2nd, 1898, at 71°30′S, 85°16′W.

83 J. J. Taljaard, *Development, Distribution and Movement of Cyclones and Anticyclones in the South Hemisphere during IGY*, J. Appl. Meteo. **6**(1967)973–987; Mark R. Sinclair, *A Climatology of Anticyclones and Blocking for the Southern Hemisphere*, Mon. Wea. Rev. **124**(1996)245–263.

84 Marcel Brillouin, *Original Memories of the General Circulation of the Atmosphere*, Mon. Wea. Rev. **29**(1901)300–304.

85 William M. Ferrel, Jan. 29th, 1817 – Sep. 18th, 1891; an American meteorologist who developed a general theory of atmospheric air circulation with no relationship (?) to W. F. Ferrell, Mon. Wea. Rev. **26**(1898)457–458.

86 Willaim Ferrel, *A Popular Treatise on the Winds Comprising the General Motions of the Atmosphere, Monsoons, Cyclones, Tornadoes, Waterspouts, Hail-Storms, Ect.*, MacMillan & Co., London, 1890, *cf.* p. 152.

87 William H. Hobbs, *Characteristics of Existing Glaciers*, MacMillan, New York, 1911, *cf.* p. 265. On page 273, Hobbes presents a visionary comment "… snow behaves like the sand of the desert, and, further, like it, though, of less intensity, it has eolian movements." Hobbes also notices the resemblance of the curve of profile [of sand dune] to that of continental glaciers, and continues "Recognition of the importance of wind transportation in connection with continental glaciers raises the question as to how far their peculiar marginal sections are controlled by this factor. There is evident in the sections across the margin of the inland-ice an approximation to a regular curve (see Fig. 132). The resemblance of this curve to the curve of profile on the lee side of sand dunes (see Fig. 136) is most striking. Fringing glaciers of both the Arctic and Antarctic regions are in reality dunes of granular sand like snow, and it seems likely that the margins of the inland-ice are broadly moulded by this process (see Fig. 137). The relative parts played by wind transportation upon the surface and by ice regelation and flow beneath it are yet to be determined. The sharp contact of névés now with blue glacier ice at the head of the Ferrar outlet appears to bear upon this point." [névé: the upper part of a glacier, above the limit of perpetual snow]. In reality, Hobbes is suggesting that sand and snow driven by wind are self-organized criticalities. The science of self-organized criticality was recognized and developed eighty years later in the 1990s. For more, see Per Bak, *How Nature Works: The Science of Self-organized Criticality*, Copernicus, 1996. In physics "The terminology granular matter refers to systems with a large number of hard objects (grains) of mesoscopic size ranging from millimeters to meters. Geological examples include desert sand and the rocks of a landslide. But the scope of such systems is much broader, including powders and snow, edible products such a seeds and salt, medical products like pills, and extraterrestrial systems such as the surface regolith of Mars and the rings of Saturn". For more, see James W. Dufty, *Granular Fluids*, http://arxiv.org/pdf/0709.0479.

88 H. Arctowski, *Antarctic Meteorology*, Mon. Wea. Rev. November 1904, *cf.* p. 519.

89 E. Shackleton, *The Heart of the Antarctic: Being the Story of the British Antarctic Expedition 1907–1909*, W. Heinemann, 1909, Vol. I., *cf.* p. viii.

90 William H. Hobbs, *The Fixed Glacial Anticyclone compared to the Migrating Anticyclone*, Proceedings of the American Philosophical Society **60**(1921)34–42.

91 Wilhelm Meinardus, *Tasks and Problems for Meteorological Explorations in the Antarctic*, Geographische Zeitachrift, Leipzig **20**(1914)18–34.

92 William J. S. Lockyer, *Southern Hemisphere Surface Air Circulation: Being a Study of the Mean Monthly Pressure Amplitudes, the Tracks of the Anticyclones and Cyclones, and the Meteorological Records of Several Antarctic Expeditions*, Printed for His Majesty's Stationery Office, London, 1910.

93 Erich von Drygalski, Wilhelm Meinardus and Ludwig Mecking, *Deutsche Südpolar-Expedition, 1901–1903: Meteorologischer Atlas*, Georg Reimer, Berlin, 1905.

94 G. Murray (Ed.), *The Antarctic Manual for the Use of the Expedition of 1901*, Royal Geographical Society, London, 1901, *cf.* p. 31.

95 Thomas K. Gaisser, *IceCube: Status and Results*, http://arxiv.org/pdf/1108.1838; See also http://www.icecube.wisc.edu/.

96 Francis Galton, *A Development of the Theory of Cyclones*, Proceedings of the Royal Society of London, 1863, *cf.* p. 385.

97 Francis Galton, *Co-Relations and their Measurement, Chiefly from Anthropometric Data*, Proceedings of the Royal Society of London, 1888, *cf.* p. 135–145.

98 Francis Galton, *Regression Towards Mediocrity in Hereditary Stature*, The Journal of the Anthropological Institute of Great Britain and Ireland **15**(1886)246–263.

99 William Pike, *William Henry Dines (1855–1927)*, Weather **60**(2005)308–315.

100 *National Antarctic Expedition 1901–1904, Meteorology. Part I: observations at winter quarters and on sledge journeys with discussions by various authors*, Published by the Royal Society, London, 1908.

101 *Ibid.*, *cf.* p. 471.

102 George C. Simpson, *British Antarctic Expedition, 1910–1913, Meteorology*, Vol. I, *Discussion*, Thacker, Spink, & Co., Calcutta, 1919, *cf.* p. iv.

103 http://www.ngdc.noaa.gov/mgg/image/2minrelief.html

104 Robert F. Scott, *The Voyage of the 'Discovery'*, MacMillan & Co., London, 1905, Vol. II, *cf.* p. 215 and 217.

105 Robert Wharton, Barney Roberts, Erick Chiang, John Lynch, Carol Roberts, Corinne Buoni and Dal Andersen, *Use of Antarctic Analogs to Support the Space Exploration Initiative*, 1 December 1990, *cf.* p. 15. NASA/NSF. (NASA-TM-108000).

106 'When daylight came on the morning of the sixth day out we saw and felt that the James Caird had lost her resiliency. She was not rising to the oncoming seas. The weight of the ice that had formed in her and upon her during the night was having its effect, and she was becoming more like a log than a boat. The situation called for immediate action … The reduction of weight relieved the boat to some extent, and vigorous chipping and scraping did more. We had to be very careful not to put axe or knife through the frozen canvas of the decking as we crawled over it, but gradually we got rid of a lot of ice. The James Caird lifted to the endless waves as though she lived again.' Ernest Shackleton, *South: The Story of Shackleton's Last Expedition, 1914–1917*, MacMillan Co, New York, 1920, *cf.* p. 172 & 173.

107 C. Donald Ahrens, *Essentials of Meteorology: An Invitation to the Atmosphere*, Thompson Books/Cole, Belmont, 2008, *cf.* p. 9.

108 Charles Chree and Napier Shaw, (Eds.), *Meteorological Glossary*, Great Britain. Meteorological Office, H. M. Stationery Office, London, 1918, *cf.* p. 164.

109 Wilhelm Meinardus, *Tasks and Problems for Meteorological Explorations in the Antarctic*, Mon. Wea. Rev., April 1914, *cf.* p. 225.

110 George C. Simpson, *British Antarctic Expedition, 1910–1913, Meteorology*, Vol. I, *Discussion*, Thacker, Spink, & Co., Calcutta, 1919, *cf.* p. 271.

111 Such camouflaged theses were described recently by Barbara Goldsmith in *Obsessive Genius: The Inner World of Marie Curie*, W. W. Norton, 2005. Skłodowska-Curie was dedicated to her work and slightly reclusive, but she was hardly an obsessive personality and did not participate in the first wave of feminism.

112 *Ibid.*, *cf.* p. 42.

113 R. R. Burton, *Scott's Last Expedition: The Upper Air Observations*, Weather **61**(2006)250–253.

114 George C. Simpson, *British Antarctic Expedition, 1910–1913, Meteorology*, Vol. I, *Discussion*, Thacker, Spink, & Co., Calcutta, 1919, *cf.* p. 43.

115 *Loc. cit.*

116 http://en.wikipedia.org/wiki/Moon.

117 James Murray, *Appendix V. Meteorology. A Summary of Results*, in E. Shackleton, *British Antarctic Expedition, 1907–9, Under the Command of Sir E. H. Shackleton, C. V. O. Reports on the Scientific Investigations*, W. Heinemann, London, 1910, *cf.* p. 415.

118 http://en.wikipedia.org/wiki/Halo_(optical_phenomenon). See also Robert Greenler, *Rainbows, Halos, and Glories*, Cambridge University Press, Cambridge, 1990.

[119] George C. Simpson, *British Antarctic Expedition, 1910–1913, Meteorology*, Vol. I, *Discussion*, Thacker, Spink, & Co., Calcutta, 1919, *cf.* p. vii.

[120] Ernest Shackleton, *South: The Story of Shackleton's Last Expedition, 1914–1917*, MacMillan Co., New York, 1920.

[121] David T. Murphy, *German Exploration of the Polar World: A History, 1870–1940*, University of Nebraska Press, 2002.

[122] Ferdinand von Wrangell, *Narrative of an Expedition to the Polar Sea, in the Years 1820, 1821, 1822, & 1823*, Tames Madden and Co., London, 1840, *cf.* p. 146.

[123] T. R. Parish and D. H. Bromwich (Eds.) (2002), *Ross Island Meteorology Experiment (RIME), BPRC Misc. Ser. M-424*, 39 *cf.* p. 4, Byrd Polar Res. Cent., Ohio State Univ., Columbus.

[124] http://polarmet.osu.edu/RIME-01/pdf_docs/rime_sciplan_all_final.pdf The work of N. A. Streten, *Antarctic Meteorology: The Australian Contribution Past, Present and Future* published in Australian Meteorological Magazine, 1980 pages 105–140 was also acknowledged, especially Fig. 2c. Dr Simpson's contribution was, however, acknowledged later by T. R. Parish, J. J. Cassano, and M. W. Seefeldt (2006), *Characteristics of the Ross Ice Shelf Air Stream as Depicted in Antarctic Mesoscale Prediction System Simulations*, J. Geophys. Res., 111, D12109.

[125] George C. Simpson, *British Antarctic Expedition, 1910–1913, Meteorology*, Vol. I, *Discussion*, Thacker, Spink, & Co., Calcutta, 1919, *cf.* p. 110.

[126] *Ibid*., *cf.* p. 112.

[127] *Loc. cit*.

[128] L. Mahrt, D. Vickers, R. Nakamura, M. R. Soler, J. Sun, S. Burns, and D. H. Lenschow, *Shallow Drainage Flows*, Boundary-Layer Meteorol. **101**(2001)243–260; Ian A. Renfrew, *The Dynamics of Idealized Katabatic Flow Over a Moderate Slope and Ice Shelf*, Q. J. R. Meteorol. Soc. **130**(2004)1023–1045; R. J. Zammett and A. C. Fowler, *Katabatic Winds on Ice Sheets: A Refinement of the Prandtl Model*, J. Atmos. Sci. **64**(2007)2707–2716; M. W. Seefeldt, *An Analysis of the Ross Ice Shelf Low-level Wind Field Using Surface Observations and Modeling Studies*, Ph. D. thesis, Department of Atmospheric and Oceanic Sciences, University of Colorado, 2007 and references therein; M. R. Van Den Broeke and N. P. M. Van Lipzig, *Factors Controlling the Near-Surface Wind Field in Antarctica,* Mon. Wea. Rev. **131**(2003)733–743; Thomas R. Parish and David H. Bromwich, *Reexamination of the Near-Surface Airflow over the Antarctic Continent and Implications on Atmospheric Circulations at High Southern Latitude,* Mon. Wea. Rev. **135**(2007)1961–1973; Johanna C. Speirs, Daniel F. Steihoff, Hamish A. McGowan, David H. Bromwich and Andrew J. Monaghan, *Foehn Winds in the McMurdo Dry Valleys, Antarctica: The Origin of Extreme Warming Events*, J. Climate. **23**(2010)3577–3598; K. Sienicki, *Comments on the Regional Climate Variability Driven by Foehn Winds in the McMurdo Valleys, Antarctica*, arxiv.org/abs/1308.4630.

[129] Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R. F. Scott, R. N., C. V. O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 335.

[130] Albert Einstein, 1949, quoted in *Albert Einstein: Philosopher, Scientist*, P.A. Schilpp, Ed., Library of Living Philosophers, Evanston, 3rd edition (1970), *cf.* p. 85.

[131] Per Bak, *How Nature Works: The Science of Self-organized Criticality*, Copernicus, 1996, *cf.* p. 1.

[132] Lewis Fry Richardson, *Weather Prediction by Numerical Process*, Cambridge University Press, Cambridge, 1922, *cf.* p. 65.

[133] Ian Stewart, *Does God Play Dice?: The New Mathematics of Chaos,* Penguin, London, 1997.

[134] Lewis Fry Richardson, *Weather Prediction by Numerical Process*, Cambridge University Press, Cambridge, 1922, *cf.* p. 66.

135 Nigel Goldenfeld, Carl Woese, *Life is Physics: Evolution as a Collective Phenomenon Far from Equilibrium*, http://arxiv.org/abs/1011.4125

136 William Bialek, Andrea Cavagna, Irene Giardina, Thierry Mora, Edmondo Silvestri, Massimiliano Viale and Aleksandra M. Walczak, *Statistical Mechanics for Natural Flocks of Birds*, http://arxiv.org/abs/1107.0604.

137 Carolyn Strange and Alison Bashford, *Griffith Taylor: Visionary, Environmentalist, Explorer*, University of Toronto Press, Toronto, 2008.

138 In comparison to valley glaciers, *glacierets* are very small and have little or no movement. Glacierets form from either drifted snow or snow that has avalanched from above.

139 T. Griffith Taylor, *The Physiography of the McMurdo Sound and Granite Harbour Region: British Antarctic Terra Nova Expedition, 1910–1913*, Harrison, London, 1922, *cf.* p. 69.

140 *Ibid.*, *cf.* p. 75.

141 David Deutsch, Artur Ekert and Rossella Lupacchini, *Machines, Logic and Quantum Physics* http://arxiv.org/pdf/math/9911150

142 Benoît B. Mandelbrot, *How Long is the Coast of Britain? Statistical Self-similarity and Fractional Dimension*, Science **156**(1967)636–638. Here. I wish to add Mandelbrot's comment about the weekly magazine *Science* "accepting this text for publication with marvelous promptness. The referee liked very much my idea that fractal dimension is indeed important in this context, and identified himself as Hugo Steinhaus (1887–1972). But who told *Science* editors that Steinhaus was their man and alive and well in Wroclaw, Poland? I bet it was his former student Mark Kac (1914–1984) whom I knew well." Mandelbrot (1924–2010) himself was born in Warsaw. Steinhaus, Kac, Stefan Banach, Alfred Tarski, Staniaław Ulam and numerous Polish mathematicians belonged to the so-called Polish School of Mathematics, which contributed many fundamental theories. For more, see: Stanisław Ulam, *Adventures of a Mathematician, illustrated with photographs,* Charles Scribner & Sons, New York, 1976; Kazimierz Kuratowski, *A Half Century of Polish Mathematics: Remembrances and Reflections*, Pergamon Press, Oxford, 1980; A. B. Feferman, S. Feferman, *Alfred Tarski: Life and Logic (Cambridge Concise Histories)*, Cambridge University Press, Cambridge, 2008.

143 http://www.math.yale.edu/mandelbrot/web_pdfs/howLongIsTheCoastOfBritain.pdf

144 Benoît B. Mandelbrot, *The Fractal Geometry of Nature*, W. H. Freeman and Co., New York, 1982.

145 http://en.wikipedia.org/wiki/Vilfredo_Pareto#cite_ref-2

146 George K. Zipf, *Human Behavior and the Principle of Least Effort*, Addison-Wesley Press, Cambridge (MA), 1949. See also Alexander Saichev, Yannick Malevergne and Didier Sornette, *Theory of Zipf's Law and Beyond*, Springer, Heildelberg, 2010.

147 A. Hernando, D. Puigdomènech, D. Villuendas, C. Vesperinas, A. Plastino, *Zipf's Law from a Fisher Variational-principle*, http://arxiv.org/pdf/0908.0501

148 This issue needs to be explained more thoroughly. The mean value of our power-law distributed quantity x is given by the expression $x = \int_{x_{\min}}^{\infty} xp(x)\,dx = c\int_{x_{\min}}^{\infty} x^{-\alpha+1}dx = \frac{c}{2-\alpha}\left[x^{-\alpha+2}\right]_{x_{\min}}^{\infty}$.
The obtained expression for the mean value becomes infinite for any $\alpha < 2$. Thus the power-law distributed quantity for low values of α have no finite mean value. Surely one can compute the mean from a finite sample of finite power-law distributed quantities. However, as per its definition, a true mean value must be calculated from an infinite (∞) number of samples, and thus it will yield an infinite mean value.

149 S. Lovejoy and D. Schertzer, *Generalized Scale Invariance in the Atmosphere and Fractal Models of Rain*, Water Resources Research **21**(1985)1233–1250; Stefan Hergarten, *Self Organized Criticality in Earth Systems*, Springer, Heildelberg, 2002.

150 Per Bak, *How Nature Works*, Copernicus, New York, 1995.
151 Per Bak and C. Tang and K. Wiesenfeld, *Self-Organized Criticality: An Explanation of 1/f Noise*, Physical Review Letters **59**(1987)381–384.
152 Per Bak, C. Tang and K. Wiesenfeld, *Self-organized Criticality*, Physical Rev. A **38/1**(1988)364–374.
153 Stuart Kauffman, *Investigations*, Oxford University Press, Oxford, 2000, *cf.* p. 190.
154 Markus J. Aschwanden, *Self-Organized Criticality in Astrophysics: The Statistics of Nonlinear Processes in the Universe*, Springer, Heildelberg, 2010.
155 George C. Simpson, *British Antarctic Expedition, 1910–1913, Meteorology*, Vol. I, *Discussion*, Thacker, Spink, & Co., Calcutta, 1919, *cf.* p. 111.
156 *Ibid.*, *cf.* p. 115.
157 *Ibid.*, *cf.* p. 118.
158 Jay M. Greenberg, *Euclidean and Non-Euclidean Geometries: Development and History*, W. H. Freeman, New York, 2007.
159 Jeremy Gray, *Ideas of Space: Euclidean, Non-Euclidean, and Relativistic*, Clarendon Press, 1989.
160 George C. Simpson, *British Antarctic Expedition, 1910–1913, Meteorology*, Vol. I, *Discussion*, Thacker, Spink, & Co., Calcutta, 1919, *cf.* p. 115.
161 John Nolan, *Stable Distributions: Models for Heavy-Tailed Data*, Springer Verlag, 2010; V. Pisarenko and M. Rodkin, *Heavy-Tailed Distributions in Disaster Analysis*, Springer, 2010.
162 In reference to Figure 35, *cf.* p. 105, Vol. I, Simpson is not giving precise references for the data sources of his wind velocity frequency calculations. I am guessing that the data was taken from: Amundsen (Framheim), Captain Scott's Northern Party (Cape Adare), Nordenskiöld (Snow Hill), von Drygalski (Gauss Station), Amundsen and Captain Scott (South Polar Plateau), no source (Kerguelen), and Nansen (North Polar).
163 John Venn, *The Logic of Chance*, Macmillan and Company, London, 1888, *cf.* p. 64.
164 George C. Simpson, *British Antarctic Expedition, 1910–1913, Meteorology*, Vol. I, *Discussion*, Thacker, Spink, & Co., Calcutta, 1919, *cf.* p. 115.
165 Eric J. Steig, David P. Schneider, Scott D. Rutherford, Michael E. Mann, Josefino C. Comiso and Drew T. Shindell, *Warming of the Antarctic Ice-sheet Surface Since the 1957 International Geophysical Year*, Nature **457** (2009)459–462. The results of Steig *et al.* were refuted by Ryan O'Donnell, Nicholas Lewis, Steve McIntyre and Jeff Condon, *Improved Methods for PCA-Based Reconstructions: Case Study Using the Steig et al. (2009) Antarctic Temperature Reconstruction*, J. Climate **24**(2011)2099–2115.
166 Latin for "Take nobody's word for it".
167 Robert F. Scott, *The Voyage of the ‚Discovery'*, Vol. I, Toronto: The Copp, Clark Co., London: MacMillan and Co., 1905. *cf.* p. 50.
168 David Crane, *Scott of the Antarctic, A Life of Courage and Tragedy*, Alfred A. Knopf, New York, 2006, *cf.* p. 352.
169 James Clark Ross, *A Voyage of Discovery and Research in the Southern and Antarctic Regions, During the Years 1839–43*, John Murray, London, 1847, Vol. I, *cf.* p. 217.
170 *Ibid.*, *cf.* p. 237.
171 *Ibid.*, *cf.* p. 245.
172 Carsten E. Borchgrevink, *First on the Antarctic Continent: Being an Account of the British Antarctic Expedition, 1898–1900*, George Newnes Ltd., London, 1901, *cf.* p. 291.
173 Roald Amundsen, *The South Pole: An Account of the Norwegian Antarctic Expedition in the „Fram," 1910–1912*, John Murray, London, 1912.
174 For a review of Byrd's work, see Richard E. Byrd, *Exploring with Byrd*, G. P. Putnam's Sons, New York, 1937.

175 Robert F. Scott, *The Voyage of the 'Discovery'*, Vol. I, Toronto: The Copp, Clark Co., London: MacMillan and Co., 1905, *cf.* p. 145.
176 *Ibid.*, *cf.* p. 148.
177 Louis Bernacchi, *Saga of the 'Discovery'*, Blackie and Son, London, 1938 and Louis Ch. Bernacchi, *To the South Polar Regions: Expedition of 1898–1900*, Hurst and Blackett, London, 1901.
178 I was unable to find the exact publication date.
179 I wonder at this point about the question of the relationship between the Beaufort scale and self-organized criticality of wind. Ralf Lindau, *A New Beaufort Equivalent Scale*, http://icoads.noaa.gov/kiel/Kiel.Lindau.pdf.
180 *National Antarctic Expedition 1901–1904, Meteorology – Part I*, The Royal Society, London, 1908, *cf.* p. vii.
181 *Loc. cit.*
182 C. S. Wright and R. E. Priestley, *British Antarctic Expedition 1907–09 by Ernest Shackleton Reports on the Scientific Investigations. Meteorology by Edward Kidson*, Geographical Journal **77**(1931)61–64.
183 *Ibid.*, *cf.* p. 61.
184 As a matter of fact, Ernest Shackleton did not care about scientific results either.
185 C. S. Wright, *British Antarctic (Terra Nova) Expedition, 1910–1913: Determinations of Gravity*, Harrison and Sons, Ltd., London, 1921; Charles Chree, *British Antarctic (Terra Nova) Expedition, 1910–1913: Terrestrial Magnetism*, Harrison and Sons, Ltd., London, 1921; Charles S. Wright, *British Antarctic (Terra Nova) Expedition, 1910–1913: Observations on the Aurora*, Harrison and Sons, Ltd., London, 1921. T. Griffith Taylor, *British Antarctic (Terra Nova) Expedition, 1910–1913: The Physiography of the McMurdo Sound and Granite Harbour Region*, Harrison, London, 1922; C. S. Wright and R. E. Priestley, *Glaciology*, Harrison and Sons, Ltd., London, 1922; George Clarke Simpson, *Meteorology*, Vol. III, *Tables*, Harrison and Sons, Ltd., London, 1923; F. Debenham, *British Antarctic (Terra Nova) Expedition, 1910–1913: Report on Maps and Surveys*, Harrison and Sons, Ltd., London, 1923; Raymond E. Priestley, *British Antarctic (Terra Nova) Expedition, 1910–1913: Physiography (Robertson Bay and Terra Nova Bay Regions)*, Harrison and Sons, Ltd., London, 1923; Raymond E. Priestley, *British Antarctic (Terra Nova) Expedition, 1910–1913: The Physiography of the Ross Archipelago*, Harrison and Sons, Ltd., London, 1923; Charles S. Wright, *British Antarctic (Terra Nova) Expedition, 1910–1913: Physiography of the Beardmore Glacier Region*, Harrison and Sons, Ltd., London, 1923; H. G. Lyons, *British Antarctic (Terra Nova) Expedition, 1910–1913: Miscellaneous Data*, Harrison and Sons, Ltd., London, 1924.
186 http://scholar.google.com
187 W. N. Shaw, *On the General Circulation of the Atmosphere in Middle and Higher Latitudes*, Mon. Wea. Rev. **32**(1904)264–267.
188 *National Antarctic Expedition 1901–1904, Meteorology – Part I*, The Royal Society, London, 1908, *cf.* p. 489.
189 David Crane, *Scott of the Antarctic, A Life of Courage and Tragedy*, Alfred A. Knopf, New York, 2006, *cf.* p. 353.
190 *National Antarctic Expedition 1901–1904, Meteorology – Part II*, The Royal Society, London, 1913, *cf.* p. 4.
191 Anders O. Persson, *Hadley's Principle: Understanding and Misunderstanding the Trade Winds*, History of Meteorology **3**(2006)17–40, *cf.* p. 36. (http://www.meteohistory.org/). See also a number of excellent papers by Anders Persson on Coriolis forces published in various journals. One can read the hagiographical paper of J. Burton, *William Napier Shaw – Father of Modern Meteorology*, Weather **59**(2004)307–308.
192 http://aps.org/policy/statements/02_2.cfm#supplementary_guidelines1

193 William J. S. Lockyer, *Southern Hemisphere Surface Air Circulation: Being a Study of the Mean Monthly Pressure Amplitudes, the Tracks of the Anticyclones and Cyclones, and the Meteorological Records of Several Antarctic Expeditions*, Printed for His Majesty's Stationery Office, London, 1910.

194 *National Antarctic Expedition 1901–1904, Meteorology – Part I*, The Royal Society, London, 1908, *cf.* p. xii.

195 David Crane, *Scott of the Antarctic, A Life of Courage and Tragedy*, Alfred A. Knopf, New York, 2006, *cf.* p. 352.

Chapter 2: Analysis of the Weather Account During the *Terra Nova Expedition*

pages 67 through 104

1 http://plato.stanford.edu/entries/ceteris-paribus/

2 Linus Pauling, *How to Live Longer and Feel Better*, various editions.

3 Ernest Shackleton, *The Heart of the Antarctic, Being the Story of the British Antarctic Expedition, 1907–1909*, W. Heinemann, London, 1909.

4 The printed account of the *Discovery Expedition* (1901–1904) was written by the newly promoted Captain Scott after his return to England.

5 *The Heart of the Antarctic* and *South* journals (books) were written by Shackleton's amanuensis Edward Saunders.

6 Max Jones (Ed.), *Journals: Captain Scott's Last Expedition*, Oxford University Press, Oxford, 2006, *cf.* p. 441.

7 http://en.wikipedia.org/wiki/Leonard_Huxley_(writer)

8 Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R. F. Scott, R. N., C. V. O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913.

9 Max Jones, *The Last Great Quest: Captain Scott's Antarctic Sacrifice*, Oxford University Press, Oxford, 2003, *cf.* p. 313.

10 *Ibid.*, *cf.* p. 121.

11 *Ibid.*, *cf.* p. 123.

12 Max Jones (Ed.), *Journals: Captain Scott's Last Expedition*, Oxford University Press, Oxford, 2006, *cf.* p. 457–458.

13 *Ibid.*, *cf.* p. 457.

14 *Loc. cit.*

15 The temperature data for Feb. 16th and 25th in Dr Jones' book (Max Jones (Ed.), *Journals: Captain Scott's Last Expedition*, Oxford University Press, Oxford, 2006) are typos: where it is –6.1 and +9 and should be +6.1 and +9.5. See cross-reference, George C. Simpson, *Meteorology*, Vol. III, *Tables*, Harrison and Sons, Ltd., London, 1923, *cf.* Table 72.

16 Kurt Jacobs, *Stochastic Processes for Physicists: Understanding Noisy Systems*, Cambridge University Press, Cambridge, 2010.

17 Max Jones, *The Last Great Quest: Captain Scott's Antarctic Sacrifice*, Oxford University Press, Oxford, 2003, *cf.* p. 123.

18 *Loc. cit.*

19 Max Jones (Ed.), *Journals: Captain Scott's Last Expedition*, Oxford University Press, Oxford, 2006, *cf.* p. 469.

20 Nassim N. Taleb, *The Black Swan: The Impact of the Highly Improbable*, Random House, 2010.

21 George C. Simpson, *Meteorology*, Vol. III, *Tables*, Harrison and Sons, Ltd., London, 1923, *cf.* p. v.

22 *Ibid.*, *cf.* p. vii.

23 Max Jones, *The Last Great Quest: Captain Scott's Antarctic Sacrifice*, Oxford University Press, Oxford, 2003, *cf.* p. xxxviii.

24 Max Jones (Ed.), *Journals: Captain Scott's Last Expedition*, Oxford University Press, Oxford, 2006.

25 Roland Huntford, *Race for the South Pole: The Expedition Diaries of Scott and Amundsen*, Continuum, London, 2010.

26 Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R.F. Scott, R.N., C.V.O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 414.

27 http://www.nytimes.com/2007/01/11/arts/11iht-web.0112scottletter.4169078.html

28 Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R.F. Scott, R.N., C.V.O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 413.

29 Edward R. G. R. Evans, *South with Scott, Collins*, London, 1912. A PDF with different pagination is available at https://www.gutenberg.org/ebooks/18129.

30 Vicheslav I. Yuzefov, Ella W. Wiswell (trans.), *Northern Sakhalin to the Antarctic: The Story a Russian Participant in Scott's Expedition to the South Pole 1910–1913*, Polar Record **34**(1998)251–254.

31 https://ru.wikipedia.org/wiki/Гирев,_Дмитрий_Семёнович

32 Edward R. G. R. Evans, *South with Scott*, Collins, London, 1921, *cf.* p. 245.

33 Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R.F. Scott, R.N., C.V.O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 335.

34 George C. Simpson, *Meteorology*, Vol. III, *Tables*, Harrison and Sons, Ltd., London, 1923, *cf.* p. 666.

35 Sara Wheeler, *Cherry: A Life of Apsley Cherry-Garrard*, Random House, New York, 2002, *cf.* p. 133.

36 Elspeth Huxley, *Scott of the Antarctic*, Pan Books, 1979, *cf.* p. 263.

37 Roland Huntford, *The Last Place on Earth*, Modern Library, New York, 1999 (originally published by Atheneum, 1986), *cf.* p. 521.

38 Robert F. Scott, *Scott's Last Expedition: Being the Reports of the Journeys & the Scientific Work Undertaken by Dr E. A. Wilson and the Surviving Members of the Expedition*, Vol. II, Dodd, Mead & Company, The University Press, Cambridge, 1913, *cf.* p. 301.

39 *Ibid.*, *cf.* p. 300.

40 Cecil Meares left Cape Evans onboard the *Terra Nova* on Mar. 4th, 1912.

41 See also Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd., London, 1922, Vol. II, *cf.* p. 416.

42 In here, and throughout this chapter, I will use the decimal degrees notation of geographical locations, which is much more convenient in direct distance calculations than the traditional geographic Coordinate system. In the traditional coordinate system, Hut Point is located at 77°47′S 166°51′E, which is equivalent to –77.7833 and 166.85. In order to convert traditional coordinates (DD) to decimal degrees, one can use the formula: $DD = M/60 + S/3600$.

43 George C. Simpson, *Meteorology*, Vol. III, *Tables*, Harrison and Sons, Ltd., London, 1923, *cf.* p. 666.

44 The following comment can be found in Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, George H. Doran Company, New York, 1922, Vol. II, on page 414. I added my comments and corrections in square [*brackets*].

Now the daily distance which every 4-man party had to average from Hut Point to its turning-point and back to Hut Point, so as to be on full rations all the way, was only 8.4 geo-

graphical miles. [*I could not confirm this figure. The theoretical velocity according to Captain Scott's assumptions was 10.1 miles per day. The real velocity on the outward journey on the Ross Ice Shelf was 10.8 miles/day, and on the Antarctic Plateau it was about 10.6 miles/day. See Fig. 2.1.*] From Hut Point to the latitude in which he was last seen, 87°32′S., Scott had averaged more than ten geographical miles a day. Taking into consideration the advanced latitude, 87°32′S., at which the Second Return Party had left Scott, and the extremely good daily averages these two parties had marched on the plateau up to this point, namely 12.3 geographical miles a day; [*The average velocity of the Second Return Party was 13.5 miles/day*] seeing also that the First Return Party had averaged 14.2 geographical miles on their return from 85°3′S. [*The First Return Party average velocity was 13 miles/day*] to One Ton Depôt; and the Second Return Party had averaged 11.2 geographical miles on their return from 87°32′S, [*The average velocity of the Second Return Party at the Ross Ice Shelf was 13.2 miles/day*] to the same place, although one of the three men was seriously ill; it was supposed that all the previous estimates made for the return of the Polar Party were too late, and that the opportunity to reach One Ton Camp before them had been lost. [*Therefore, Cherry-Garrard's conclusion is incorrect*].

45 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, George H. Doran Company, New York, 1922, Vol. II, *cf.* p. 417.

46 Sara Wheeler, *Cherry: A Life of Apsley Cherry-Garrard*, Random House, New York, 2002, *cf.* p. 133.

47 *Loc. cit.*

48 Diana Preston, *A First Rate Tragedy: Robert Falcon Scott and the Race to the South Pole,* Houghton Mifflin Company, Boston, 1998, *cf.* p. 209.

49 Elspeth Huxley, *Scott of the Antarctic*, Pan Books, 1979, *cf.* p. 263.

50 *Loc. cit.*

51 Diana Preston, *A First Rate Tragedy: Robert Falcon Scott and the Race to the South Pole,* Houghton Mifflin Company, Boston, 1998, *cf.* p. 209.

52 Sara Wheeler, *Cherry: A Life of Apsley Cherry-Garrard*, Random House, New York, 2002, *cf.* p. 133.

53 Susan Solomon, *The Coldest March: Scott's Fatal Antarctic Expedition*, Yale University Press, New Haven, 2001, *cf.* p. 254.

54 Sara Wheeler, *Cherry: A Life of Apsley Cherry-Garrard*, Random House, New York, 2002, *cf.* p. 133.

55 http://library.ssec.wisc.edu/about/history

56 Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R.F. Scott, R.N., C.V.O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 283.

57 Sara Wheeler, *Cherry: A Life of Apsley Cherry-Garrard*, Random House, New York, 2002, *cf.* p. 122.

58 Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R.F. Scott, R.N., C.V.O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 213.

59 http://www.ngdc.noaa.gov/geomagmodels/IGRFGrid.jsp

60 Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R.F. Scott, R.N., C.V.O.*, Vol. I, Dodd, Mead & Company, The University Press, USA, 1913, *cf.* p. 128.

61 Sara Wheeler, *Cherry: A Life of Apsley Cherry-Garrard*, Random House, New York, 2002, *cf.* p. 123. See also endnote #19 in Captain Scott Vol. I.

62 http://www.foliosociety.com/press/the-worst-journey-in-the-world-by-apsley-cherry-garrard/

63 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd., London, 1922, Vol. II, *cf.* p. 396 and *cf.* p. 400, respectively.

64 *Ibid.*, *cf.* p. 417.
65 *Ibid.*, *cf.* p. 545.
66 Edward R. G. R. Evans, *South with Scott*, Collins, London, 1921, *cf.* p. 199.
67 Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R.F. Scott, R.N., C.V.O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 410.
68 Robert F. Scott, *Scott's Last Expedition: Being the Reports of the Journeys & the Scientific Work Undertaken by Dr E. A. Wilson and the Surviving Members of the Expedition*, Vol. II, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 309.
69 *Loc. cit.*
70 Apsley Cherry-Garrard, diary, Mar. 4th, 1912, Scott Polar Research Institute.
71 *Ibid.*, Apr. 4th entry.
72 *Ibid.*, Mar. 17th entry.
73 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd., London, 1922, Vol. II, *cf.* p. 449.
74 *Ibid.*, *cf.* p. 472.
75 *Ibid.*, *cf.* p. 474.
76 Raymond E. Priestley, *Antarctic Adventure, Scott's Northern Party*, E. P. Dutton & Company, New York, 1915, *cf.* p. 372.
77 https://www.thegazette.co.uk/London/issue/28740/page/5323
78 *Now Seeks to Clear Atkinson: Commander Evans Prepares New Statement–Defends Relief Party,* New York Times, Feb. 15th, 1913, *cf.* p. 3.
79 *Unfilled,* New York Times, Feb. 15th, 1913, *cf.* p. 3.
80 *Evans Denies Hidden Secret About Scott,* New York Times, Feb. 17th, 1913, *cf.* p. 3.
81 Max Jones, *The Last Great Quest: Captain Scott's Antarctic Sacrifice,* Oxford University Press, Oxford, 2003, *cf.* p. 113–114.
82 Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R.F. Scott, R.N., C.V.O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 306.
83 George C. Simpson, *Meteorology*, Vol. III, *Tables*, Harrison and Sons, Ltd., London, 1923, *cf.* p. 59.
84 The average temperatures of –12°F and –5°F were calculated from Mar. 27th through Mar. 31st.
85 Edward R. G. R. Evans, *South with Scott*, Collins, London, 1921, *cf.* p. 251–252.
86 Stephanie Barczewski, *Antarctic Destinies: Scott, Shackleton, and the Changing Face of Heroism*, Hambledon Continuum, 2007.
87 Collin Bull and Pat F. Wright (Eds.), *Silas: The Antarctic Diaries and Memoir of Charles S. Wright*, Ohio State University Press, 1992, *cf.* p. 344. See also Adrian Raeside, *Return to Antarctica: the Amazing Adventure of Sir Charles Wright on Robert Scott's Journey to the South Pole*, Mississauga, Ontario, John Wiley, 2009.
88 *Ibid.*, *cf.* p. 345–346.
89 *Ibid.*, *cf.* p. 347.
90 *Ibid.*, *cf.* p. 373.
91 Ernest Shackleton, *The Heart of the Antarctic, Being the Story of the British Antarctic Expedition, 1907–1909*, W. Heinemann, London, 1909.
92 Charles Chree and Napier Shaw (Eds.), *Meteorological Glossary*, H. M. Stationery Office, London, 1918, *cf.* p. 58.
93 Edward Kidson, *British Antarctic Expedition 1907–1909: Reports on the Scientific Investigations: Meteorology*, H. J. Green (Government Printer), Melbourne, 1930, *cf.* p. 136.
94 T. Griffith Taylor, *With Scott: The Silver Lining*, Smith, Elder & Co., London, 1916, *cf.* p. 443.

95 Taylor is referring to Xavier Guillaume Mertz, a Swiss explorer who went to Antarctica with the Australian expedition led by Douglas Mawson. Mertz died on Jan. 7th, 1913 due to vitamin A poisoning from eating dog livers.
96 T. Griffith Taylor, *Antarctic Adventure and Research*, D. Appleton & Co., New York, 1930, *cf.* p. 186.
97 Mark W. Seefeldt, Gregory J. Tripoli and Charles R. Stearns, *A High-Resolution Numerical Simulation of the Wind Flow in the Ross Island Region, Antarctica*, Mon. Wea. Rev. **131**(2003)435–458.
98 George C. Simpson, *Meteorology*, Vol. III, *Tables*, Harrison and Sons, Ltd., London, 1923, *cf.* p. 642.
99 Ibid., *cf.* p. 38.
100 Ibid., *cf.* p. 678 and *cf.* p. 38.
101 T. Griffith Taylor*, With Scott: The Silver Lining*, Smith, Elder & Co., London, 1916, *cf.* p. 444.
102 Raymond E. Priestley, *Antarctic Adventure, Scott's Northern Party*, E. P. Dutton & Company, New York, 1915.
103 Herbert G. Ponting, *The Great White South, Being an Account of Experiences with Captain Scott's South Pole Expedition and of the Nature Life of the Antarctic*, London, Duckworth, 1922.
104 *Ibid*., *cf.* p. 294.
105 http://trove.nla.gov.au/ndp/del/article/117965848
106 S. Murray-Smith, *Priestley, Sir Raymond Edward (1886–1974)*, Australian Dictionary of Biography, National Centre of Biography, Australian National University, http://adb.anu.edu.au/biography/priestley-sir-raymond-edward-8116/text14173, accessed Sep. 21st, 2012.
107 Raymond Priestley, *The Scott Tragedy*, Geographical Journal **68**(1926)340–342.

Chapter 3: Dr George C. Simpson's – Weather and Climate Tantamount

pages 105 through 147

1 George C. Simpson, *British Antarctic Expedition, 1910–1913, Meteorology*, Vol. I, *Discussion*, Thacker, Spink, and Co., Calcutta, 1919, *cf.* p. vi.
2 http://amrc.ssec.wisc.edu/
3 Malcolm Walker, *Antarctic Meteorology and Climatology: An Unfolding Story of Discovery*, Archives of Natural History **32**(2005)316–333. On page 324, Walker comments "This record was called by Amundsen (1913) "a fine series of observations obtained during ten months' stay in winter quarters in the Antarctic Continent." The line actually belongs to B. J. Birkeland, and appeared in *Appendix II – Remarks on the Meteorological Observations at Framheim*. See Roald Amundsen, *The South Pole: An Account of the Norwegian Antarctic Expedition in the Fram*, Vol. II, John Murray, London, 1912, *cf.* p. 372. At another instance (*cf.* p. 320), Walker makes the incorrect implied supposition that Frederick Cook and his book appendix by Henryk Arctowski were the only sources of the *Belgica* expedition's meteorological results. Dr Cook's contributions for this expedition were great, but it was Henryk Arctowski (1871–1958) and his assistant Bolesław Dobrowolski (1872–1951) who collected the first all year around meteorological record in Antarctica.
4 George C. Simpson, *Meteorology*, Vol. III, *Tables*, Harrison and Sons, Ltd., London, 1923, *cf.* p. v.
5 *Loc. cit.*

6 George C. Simpson, *Some Problems of Atmospheric Electricity*, Mon. Weather Rev. **44**(1916)115; George Simpson and F. J. Scrase, *The Distribution of Electricity in Thunderclouds*, Proc. Royal Soc. of London, Series A, **161**(1937)309–352.

7 The southern-most town in New Zealand.

8 A behavioural attribute that is distinctive and peculiar to an individual.

9 George C. Simpson, *British Antarctic Expedition, 1910–1913, Meteorology*, Vol. I, *Discussion*, Thacker, Spink, and Co., Calcutta, 1919, *cf.* p. 32.

10 http://quoteinvestigator.com/2012/06/24/climate-vs-weather/ Recently, S. Lovejoy and D. Schertzer argued that this dictum is fundamentally wrong. For more, see: http://www.physics.mcgill.ca/~gang/eprints/eprintLovejoy/esubmissions/climate.not.26.6.12.pdf

11 Sir Napier Shaw, *Manual of Meteorology*, Volume I, *Meteorology in History*, Cambridge University Press, Cambridge, 1926, *cf.* p. 256.

12 Robert F. Scott, *Scott's Last Expedition: Being the Reports of the Journeys & the Scientific Work Undertaken by* Dr. *E. A. Wilson and the Surviving Members of the Expedition*, Vol. II, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 461.

13 *Ibid.*, *cf.* p. 463.

14 Vilhjalmur Stefansson, *Misconceptions about Life in the Arctic*, Bull. Am. Geographical Soc. **45**(1913)17–32; Arthur E. Bostwick, *Meteorological Conditions of a Blizzard*, Nature **97**(1916)261; W. H. Dines, *Meteorological Conditions of a Blizzard*, Nature **97**(1916)280; L. C. W. Bonacina, *Meteorological Conditions of a Blizzard*, Nature **97**(1916)301; Otto Klotz, *Early Use of the Word "Blizzard",* Nature **98**(1916)129; Miller Christy, *Meteorological Conditions of a Blizzard*, Nature **97**(1916)341.

15 *Ibid.*, *cf.* p. 468.

16 *Loc. cit.*

17 *Ibid.*, *cf.* p. 464.

18 For a general account of wind velocity measurements during the *Terra Nova Expedition*, look in George C. Simpson, *British Antarctic Expedition, 1910–1913, Meteorology*, Vol. I, *Discussion*, Thacker, Spink, and Co., Calcutta, 1919, *cf.* p. 94.

19 *Ibid.*, *cf.* p. 95.

20 George C. Simpson, *Meteorology*, Vol. III, *Tables*, Harrison and Sons, Ltd., London, 1923, *cf.* p. 99.

21 *Ibid.*, *cf.* p. 102.

22 Noah Webster, *Webster's International Dictionary of the English Language: being the authentic edition of Webster's unabridged dictionary, comprising the issues of 1864, 1879, and 1884*, George Bell & Sons, London, 1907, *cf.* p. 5.

23 E. Kidson, *Meteorology. Reports Scientific Investigations of the British Antarctic Expedition 1907–09*, Melbourne, 1930.

24 Ernest Shackleton, *The Heart of the Antarctic, Being the Story of the British Antarctic Expedition, 1907–1909*, Vol. I & II, W. Heinemann, London, 1909.

25 George C. Simpson, *British Antarctic Expedition, 1910–1913, Meteorology*, Vol. I, *Discussion*, Thacker, Spink, and Co., Calcutta, 1919, *cf.* p. 18.

26 *Ibid.*, *cf.* p. 19.

27 *Ibid.*, *cf.* p. 20.

28 Although the 10 minute data used in Fig. 3.4 (and only) are not quality processed temperature data, the possible errors are negligible and/or insignificant at this moment of analysis. For more info on data processing, see The University of Wisconsin-Madison's Antarctic Meteorology Program at http://amrc.ssec.wisc.edu/.

29 Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R.F. Scott*, *R.N., C.V.O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 416.

30 Karl R. Popper, *Conjectures and Refutations: The Growth of Scientific Knowledge*, Routledge, London, 2002.

31 Bo N. J. Persson, *Sliding Friction: Physical Principles and Applications*, Springer-Verlag, Berlin, 1997.

32 Any arbitrary elementary physics textbook.

33 John H. Jellett, *A Treatise on the Theory of Friction*, MacMillan & Co., London, 1872, *cf.* p. 8.

34 Robert F. Scott *Scott's Last Expedition: Being the Reports of the Journeys & the Scientific Work Undertaken by* Dr. *E. A. Wilson and the Surviving Members of the Expedition*, Vol. II, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 237.

35 Dr Atkinson did not explain in 1913 why the specimens were "very important," nor did he confirm it later.

36 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. II, Constable & Company Ltd, London, 1922, *cf.* p. 546.

37 "So far, since we got amongst the disturbances we have not seen such alarming crevasses as I had expected; certainly dogs could have come up as far as this." Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R.F. Scott, R.N., C.V.O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 348. However, this is an unfounded conjecture.

38 Sara Wheeler, *Cherry: A Life of Apsley Cherry-Garrard*, Vintage, 2002, various entries.

39 For example, J. Cox, *Mechanics*, Cambridge University Press, Cambridge, 1904, Chapter XIX.

40 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. II, Constable & Company Ltd, London, 1922, *cf.* p. 455–456.

41 *Ibid.*, *cf.* p. 456–458.

42 Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R.F. Scott, R.N., C.V.O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 388.

43 *Ibid.*, *cf.* p. 389.

44 June Debenham Back (Ed.), *The Quiet Land: The Antarctic Diaries of Frank Debenham*, Bluntisham Books and the Erskine Press, 1992, *cf.* p. 102–103.

45 Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R.F. Scott, R.N., C.V.O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 409.

46 http://www.christies.com/lotfinder/lot/british-antarctic-expedition-1862251-details.aspx

47 Often, English-speaking people confuse the meaning of utilitarianism and utilitarian, and conceive these words as synonyms. An example is the e-mail Feb. 21st, 2009, to me from the Editor of Polar Record Mr. Ian R. Stone "one of them [Referee] was unclear as follows "…what is the difference in meaning between "Scott applied utilitarianism" and "Amundsen who took a utilitarian approach"? It seems to me that these two clauses mean the same". However, it is not the case. **Utilitarianism** – a theory that the aim of action should be the largest possible balance of pleasure over pain or the greatest happiness of the greatest number. **Utilitarian** – exhibiting or preferring mere utility. From Merriam-Webster.

48 Utilitarian – see above.

49 Ernest Shackleton, *The Heart of the Antarctic, Being the Story of the British Antarctic Expedition, 1907–1909*, Vol. I & II, W. Heinemann, London, 1909, Vol. I, *cf.* p. 319

50 *Ibid.*, *cf.* p. 358.

51 Roald Amundsen, *The South Pole: An Account of the Norwegian Antarctic Expedition in the Fram*, John Murray, London, 1912, Vol. II, *cf.* p. 395. See also *Ibid. cf.* p. 159.

52 *Ibid.*, *cf.* p. 397.

53 See Amundsen's diary – Sep. 14th, 1911, temperature –56°C ("Skiing very sluggish") and Sep. 11th, temperature –55.5°C ("Continually bad skiing"). But then on Sep. 16th, Amundsen noted "40 nautical miles today. T[eperature] 8 o'clock –51°[C] – When we set off this morning T[temperature] was –40.2°[C]". Taken from Roland Huntford, *Race to the South Pole: The Expedition Diaries of Scott and Amundsen*, Continuum, London, 2010.

54 Anne-Marie Kietzig, Savvas G. Hatzikiriakos, and Peter Englezos, *Physics of Ice Friction*, J. Appl. Phys. **107**(2010)081101; S. C. Colbeck, *A Review of the Processes that Control Snow Friction*, http://www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA252362; Robert Rosenberg, *Why is Ice Slippery*, Physics Today, December 2005, *cf.* p. 50.

55 William E. Parry, *Three Voyages for the Discovery of a Northwest Passage from the Atlantic to the Pacific, and Narrative of an Attempt to Reach the North Pole*, Vol. I & II, John Murray, London, 1828, Vol. II, *cf.* p. 278.

56 Edward Wilson, *Diary of the Discovery Expedition*, Blandford Press, London, 1966, *cf.* p. 150.

57 Robert F. Scott, *The Voyage of the "Discovery"*, Vol. I and II, The Copp, Clark Co., Toronto, MacMillan and Co., London, 1905, Vol. II, *cf.* p. 26.

58 *Loc. cit.*

59 Roald Amundsen, *The South Pole: An Account of the Norwegian Antarctic Expedition in the Fram*, John Murray, London, 1912, Vol. II, *cf.* p. 135.

60 At the time of writing this chapter, I noticed the question of the time convention that Captain Amundsen used during his journey to the South Pole. My concern results from the following observations. At any point of Earth's surface (with exclusion of exact location of the South and North Poles), anyone travelling south should observe the Sun exactly in the south direction at noon local time. This, of course, applies also to travellers to the South Pole from Cape Evans and Framheim.

When Captain Amundsen reached the South Pole and when Captain Scott arrived at the Pole, the Sun's altitude was 23.2° and 21.1°, respectively. In both cases, the Sun was for 24h above the horizon. It is well documented that Captain Scott's expedition upon arriving in Antarctica used 'Time. 12 hours fast on G.M.T.'[See Simpson, Vol. III, *cf.* p. vii]. In modern terms, Captain Scott used New Zealand Standard Time (NZST) at Cape Evans and during his journey to the South Pole. Thus, at every noon during his trip, Captain Scott was facing at a variable altitude the Sun exactly due south. If at any point of the journey toward the Pole (and at noon time) he turned back to Cape Evans, the Sun was directly behind him. In order to have the Sun on his back all the way during the expedition, he should assume night marches on the outward journey and day marches on the return journey.

The same comments must also apply to Captain Amundsen, if he used NZST at Framheim and during his *South Pole Journey*. However, from Amundsen's narrative and journals, it is not clear at all what time zone he was using. The only straightforward information can be found in the meteorological Appendix, which appeared in the second volume of Captain Amundsen's South Pole account (Vol. II, *cf.* p. 384) 'Times of day are always in local time. The date was not changed on crossing the 180th meridian.'

Upon arriving at the South Pole, Captain Amundsen on page 76 of his journal indicated the actual corrected date, Dec. 14th. (Roland Huntford, *Race to the South Pole: The Expedition Diaries of Scott and Amundsen*, Continuum, London, 2010, *cf.* p. 185). On Dec. 16th and 18th, Captain Amundsen in his journal makes reference to Framheim time.

But then, what was Captain Amundsen commenting after turning back to Framheim by writing 'We intended in future to travel at night […] we should have the sun behind us'. Bjaaland also noted this in his diary on Dec. 18th, 1911 'we started homeward at 8 o'clock

this evening, we now travel at night'. If Captain Amundsen was using NZST, then by turning around toward Framheim he would have the Sun at his back, and no need to change the travel time from day to night. Conversely, if Captain Amundsen was using NZST but, on the contrary to Captain Scott, the hours between 6p.m. until 6a.m. he was calling daytime, than on his outward daytime journey the Sun was at his back. Consequently, after turning back (north) he must change his marches for night marches to have the Sun at his back.

Therefore, both explorers during their return journey travelled with the Sun at their back. Captain Scott called it day time according to NZST convention, and Captain Amundsen on the contrary.

On their return leg, Captain Amundsen accounted for time related fuzziness (Amundsen, Vol. II, *cf.* p. 149)

> With most of us the ideas of day and night began to get rather mixed. „Six o'clock," someone would answer, when asked the time. „Yes, in the morning," remarks the other. „No; what are you talking about?" answers the first one again; „it's evening, of course." The date was hopeless; it was a good thing if we remembered the year. Only when writing in our diaries and observation books did we come across such things as dates; while at work we had not the remotest idea of them.

61 Roland Huntford, *The Last Place on Earth*, Modern Library, New York, 1999, *cf.* p. 477.

62 W. H. Dines, *Notes on the Readings of the Aspiration Psychrometer, and of the* Dry *and Wet Bulb Thermometers, and on the Observations of Evaporation and Precipitation, and of the Evaporation of Ice* in W. N. Shaw, *Meteorology: National Antarctic Expedition 1901–1904, Part I: Observations at Winter Quarters and on Sledge Journeys*, Royal Society, London, 1908, *cf.* p. 471. See also George C. Simpson, *British Antarctic Expedition, 1910–1913, Meteorology*, Vol. I, *Discussion*, Thacker, Spink, and Co., Calcutta, 1919, *cf.* p. iv.

63 Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R.F. Scott, R.N., C.V.O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 324.

64 Ernest Shackleton, *The Heart of the Antarctic, Being the Story of the British Antarctic Expedition, 1907–1909*, Vol. I & II, W. Heinemann, London, 1909, Vol. I, *cf.* p. viii.

65 Roald Amundsen, *The South Pole: An Account of the Norwegian Antarctic Expedition in the Fram*, Vol. I and II, John Murray, London, 1912, Vol. I, *cf.* p. 377.

66 *Ibid.*, *cf.* p. 378.

67 *Loc cit.*

68 *Ibid.*, *cf.* p. 379.

69 George C. Simpson, *British Antarctic Expedition, 1910–1913, Meteorology*, Vol. I, *Discussion*, Thacker, Spink, and Co., Calcutta, 1919, *cf.* p. 30.

70 *Loc. cit.*

71 *Loc. cit.*

72 *Loc. cit.*

73 Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R.F. Scott, R.N., C.V.O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 401.

74 George C. Simpson, *British Antarctic Expedition, 1910–1913, Meteorology*, Vol. I, *Discussion*, Thacker, Spink, and Co., Calcutta, 1919, *cf.* p. 32.

75 Persi Diaconis and Frederick Mosteller, *Methods for Studying Coincidences*, J. Am. Stat. Ass. **84**(1989)853-861.

76 Susan Solomon, *The Coldest March: Scott's Fatal Antarctic Expedition*, Yale University Press, New Haven, 2001, *cf.* p. 165.

77 http://www.angio.net/pi/piquery. The string and surrounding digits: 0869916487845706 1974**6061868**48541113175554851119.

78 *Ibid.*, the string and surrounding digits: 29619473508075816824**30031912**572065600 03069134614.

79 Home at the Pole – the name of Captain Amundsen camp at the South Pole.

80 George C. Simpson, *Scott's Polar Journey and The Weather*, Halley Lecture delivered on 17 May, 1923, Clarendon Press, Oxford, 1926, *cf.* p. 29.

81 A part of Fig. 5 in Simpson's Halley Lecture, to which he is referring, is used by me to derive my Fig. 2.6.

82 Susan Solomon, *The Coldest March: Scott's Fatal Antarctic Expedition*, Yale University Press, New Haven, 2001; Susan Solomon and Charles R. Stearns, *On the Role of the Weather in the Deaths of R. F. Scott and his Companions*, Proc. Natl. Acad. Sci. USA, **96**(1999)13012–13016.

83 Provided that the averaging procedure is physically and mathematically sound.

84 George C. Simpson, *British Antarctic Expedition, 1910–1913, Meteorology*, Vol. I, *Discussion*, Thacker, Spink, and Co., Calcutta, 1919, *cf.* p. 111.

85 George C. Simpson, *Scott's Polar Journey and The Weather*, Halley Lecture delivered on 17 May, 1923, Clarendon Press, Oxford, 1926, *cf.* p. 29.

86 *National Antarctic Expedition 1901–1904, Meteorology. Part I: Observations at Winter Quarters and on Sledge Journeys with Discussions by Various Authors*, Published by the Royal Society, London, 1908; E. Kidson, *Meteorology. Reports Scientific Investigations of the British Antarctic Expedition 1907–09*, Melbourne, 1930; George C. Simpson, *British Antarctic Expedition 1910–1913: Meteorology*, Vol. III, *Tables*, Harrison and Sons, Ltd., London, 1923.

87 John Woods, *The Death of Argument: Fallacies in Agent Based Reasoning*, Springer, 2004; Wikipedia contains a fair review of many fallacies. http://en.wikipedia.org/wiki/Fallacy.

88 Peter Houtlosser and Agnes van Rees (Eds.), *Considering Pragma-Dialectics*, Routledge, 2006. See also Christopher W. Tindale, *Fallacies and Argument Appraisal (Critical Reasoning and Argumentation)*, Cambridge University Press, Cambridge, 2007; Daniel Kahneman, *Thinking, Fast and Slow*, Allen Lane, 2011.

89 George C. Simpson, *British Antarctic Expedition, 1910–1913, Meteorology*, Vol. I, *Discussion*, Thacker, Spink, and Co., Calcutta, 1919, *cf.* p. 9.

90 *Ibid.*, *cf.* p. 12.

91 Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R. F. Scott, R. N., C. V. O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 410.

92 George C. Simpson, *Scott's Polar Journey and the Weather*, Clarendon Press, Oxford, 1926, *cf.* p. 28.

93 George C. Simpson, *British Antarctic Expedition, 1910–1913, Meteorology*, Vol. I, *Discussion*, Thacker, Spink, and Co., Calcutta, 1919, *cf.* p. 13.

94 *Ibid.*, *cf.* p. 51.

95 George C. Simpson, *Scott's Polar Journey and the Weather*, Clarendon Press, Oxford, 1926, *cf.* p. 30.

96 http://www.metoffice.gov.uk/weather/marine/guide/beaufortscale.html

97 George C. Simpson, *Scott's Polar Journey and the Weather*, Clarendon Press, Oxford, 1926, *cf.* p. 31.

98 George C. Simpson, *British Antarctic Expedition, 1910–1913, Meteorology*, Vol. I, *Discussion*, Thacker, Spink, and Co., Calcutta, 1919, *cf.* p. 44.

99 *Ibid.*, *cf.* p. 51.

100 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. II, *cf.* p. 420, 531 and 552.

Chapter 4: Dr Solomon's Fabrication of Meteorological Data, Fallacious Analysis and Temperature Mania

pages 148 through 212

1 Lloyd Lewis, *Sherman: Fighting Prophet,* Harcourt, Brace, and Company, New York, 1932, *cf.* p. 137.

2 Karl R. Popper, *Conjectures and Refutations: The Growth of Scientific Knowledge*, Routledge and Paul Kegan, London, 1962, *cf.* p. 216.

3 http://ori.hhs.gov/definition-misconduct and 42 Code of Federal Regulations Sec. 689.1(a).

4 Gabrielle Walker, *In from the Cold* – interview with S. Solomon, New Scientist, Oct. 13th, 2001, *cf.* p. 47.

5 Hugh G. Gauch, *Scientific Method in Practice*, Cambridge University Press, Cambridge, 2003.

6 Susan Solomon, *The Coldest March: Scott's Fatal Antarctic Expedition*, Yale University Press, New Haven and London, 2001, *cf.* p. 288.

7 *Ibid.*, *cf.* p. 164.

8 For insightful discussion, see: Didier Sornette, *Why Stock Markets Crash?*, Princeton University Press, 2003; Thomas A. Bass, *The Predictors: How a Band of Maverick Physicists Used Chaos Theory to Trade Their Way to a Fortune on Wall Street*, various editions; Peter L. Bernstein, *Against the Gods: The Remarkable Story of Risk*, John Wiley & Sons, New York, 1996; Nassim N. Taleb, *The Black Swan: The Impact of the Highly Improbable*, various editions.

9 Susan Solomon and Charles R. Stearns, *On the Role of the Weather in the Deaths of R. F. Scott and his Companions*, PNAS **96**(1999)13012–13016.

10 http://www.pnas.org/content/96/23/13012.full.pdf

11 *Peer review and the "ole boys network*" see http://occamstypewriter.org/stevecaplan/2011/10/23/peer-review-and-the-ole-boys-network/ (accessed Mar. 15th, 2013).

12 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. II, *cf.* p. 574.

13 Werner Schwerdtfeger, *Weather and Climate of the Antarctic,* Elsevier, Amsterdam, 1984, *cf.* p. 156.

14 PNAS, *cf.* p. 13014.

15 Krzysztof Sienicki, A lecture during the conference Polar Climatology, Gdynia, May 21st, 2011. PPT presentation supporting the lecture is available on request.

16 https://archive.org/details/meteorology03simpuoft

17 George C. Simpson, *British Antarctic Expedition, 1910–1913, Meteorology*, Vol. I, *Discussion*, Thacker, Spink, and Co., Calcutta, 1919, *cf.* p. 19.

18 On Mar. 4th, 1912, the recorded minimum temperature was –24.0°F, while during the day temperature –25°F was reported at 9 p.m. See Simpson, Vol. III, *cf.* p. 641.

19 PNAS, *cf.* p. 13014.

20 Susan Solomon, *The Coldest March: Scott's Fatal Antarctic Expedition*, Yale University Press, New Haven and London, 2001, *cf.* p. 293.

21 George C. Simpson, *Meteorology*, Vol. III, *Tables*, Harrison and Sons, Ltd., London, 1923, *cf.* p. 642 and George C. Simpson,, *British Antarctic Expedition, 1910–1913, Meteorology*, Vol. I, *Discussion*, Thacker, Spink, and Co., Calcutta, 1919, *cf.* p. 18.

22 *Ibid.* , *cf.* p. 19.

23 Christian Rolland, *Spatial and Seasonal Variations of Air Temperature Lapse Rates in Alpine Regions*, J. Clim. **16**(2003)1032–1046; Justin R. Minder, Philip W. Mote and Jessica D. Lundquist, *Surface Temperature Lapse Rates over Complex Terrain: Lessons from the Cascade Mountains*, J. Geophys. Res. Vol. 115, D14122, doi:10.1029/2009JD013493, 2010.

24 For Elaine AWS, see:
ftp://amrc.ssec.wisc.edu/pub/aws/10min/rdr/1988/namelist88
ftp://amrc.ssec.wisc.edu/pub/aws/10min/rdr/1989/namelist89
ftp://amrc.ssec.wisc.edu/pub/aws/10min/rdr/1990/namelist90
ftp://amrc.ssec.wisc.edu/pub/aws/10min/rdr/1991/namelist91
ftp://amrc.ssec.wisc.edu/pub/aws/10min/rdr/1992/namelist92
ftp://amrc.ssec.wisc.edu/pub/aws/10min/rdr/1993/namelist93
For Schwerdtfeger AWS, see:
ftp://amrc.ssec.wisc.edu/pub/aws/10min/rdr/1992/namelist92
ftp://amrc.ssec.wisc.edu/pub/aws/10min/rdr/1995/namelist95

25 Since the International Meteorological Conference in Warsaw, Poland in 1935 (see for example Nature **136**(1935)613–614), the World Meteorological Organization formalized "normal," or better to say, climatological temperature at a given location as one calculated for the period 1901–1930. The assumed 30 years standard is updated every decade. See also: S. Lovejoy and D. Schertzer, *The Climate is not what You Expect,* Bull. Amer. Meteor. Soc. *(submitted 6/12)*; Shaun Lovejoy. *What is climate?*, Eos, Transactions American Geophysical Union **94**(2013)1–3. Reid A. Bryson, *The Paradigm of Climatology: An Essay*, Bull. Amer. Meteor. Soc. **78**(1997)449.

26 PNAS, *cf.* p. 13015.

27 *Loc. cit.*

28 *Loc. cit.*

29 http://amrc.ssec.wisc.edu/

30 George C. Simpson, *Meteorology*, Vol. III, *Tables*, Harrison and Sons, Ltd., London, 1923., *cf.* p. vii and George C. Simpson, *British Antarctic Expedition, 1910–1913, Meteorology*, Vol. I, *Discussion*, Thacker, Spink, and Co., Calcutta, 1919, *cf.* p. 10.

31 PNAS, *cf.* p. 13015.

32 The Schwerdtfeger weather station data for 1992 and 1995 are not usable as complete years without caveats, due to its malfunctioning.

33 Isaac Newton.

34 http://www.cspeirce.com/

35 Charles S. Peirce, *Chance, Love and Logic*, Kegan Paul, Trench, Trubner & Co., London, 1923, *cf.* p. 59.

36 Aristotle: *On Sophistical Refutations, On Coming To-be and Passing-away, On the Cosmos*, William Heinemann Ltd., London, 1925.

37 Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R. F. Scott, R. N., C. V. O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 410.

38 PNAS, *cf.* p. 13016.

39 For the meteorological community and in the Beaufort wind scale, a storm means winds of 25–28 m/s! (89–102 km/h).

40 PNAS, *cf.* p. 13016.

41 David Whitehouse, *Scott Caught out by Cold Snap*, http://news.bbc.co.uk/2/hi/science/nature/509940.stm but he did not read the paper. The BBC science editor Dr Whitehouse's knowledge of the Captain Scott *Terra Nova Expedition* is nil. His comment "Many did not believe him [Dr Simpson], claiming Capt Scott's plan for hauling sleds by hand

[*sic!*] was inefficient. When he died, Scott had half a sled's worth of rocks [*sic*] collected for scientific study. Critics said half of that weight in seal meat [*sic*] would have saved him" speaks for itself. The origin of Dr Whitehouse's figures "a journey [Scott] of more than 1,500 km" and "Capt Scott was just 13 miles (20 kilometers) away from the supplies at one-ton depot" are entirely unknown.

42 Susan Solomon, *The Coldest March: Scott's Fatal Antarctic Expedition*, Yale University Press, New Haven and London, 2001.

43 Gabrielle Walker, *In from the Cold* – interview with S. Solomon, New Scientist, Oct. 13th, 2001, *cf.* p. 47.

44 http://antarcticsun.usap.gov/features/contenthandler.cfm?id=2181

45 See for example: Bryan C. Storey, *Reviewed work: The Coldest March: Scott's Fatal Antarctic Expedition by Susan Solomon*, The International History Review **25**(2003)174–175; B. A. Riffenburgh, *The Coldest March: Scott's Fatal Antarctic Expedition*, Endeavour **26**(2002)78–79; Robert MacFarlane, *In from the Cold*, The Observer, Sunday Oct. 7th, 2001; Ellis L. Yochelson, *The Coldest March: Scott's Fatal Antarctic Expedition by Susan Solomon*, Isis **93**(2002)712–713; John Splettstoesser, Arctic, Dec. 1st, 2001, *The Coldest March: Scott's Fatal Antarctic Expedition* Arctic, Dec. 1st, 2001; Cornelia Lüdecke, *Tragic Outcome of Extreme Conditions*, Nature **414**(2001)150–151; Kenneth Chang, *How Bad Luck Tipped the Scales to Disaster*, Aug. 28th, 2001, The New York Times; Sara Wheeler, *Great Scott?*, September 2, 2001, The New York Times; Jonathan Glancey, The Guardian, *We could be Heroes*, Nov. 10th, 2001; Gabrielle Walker, Oct. 13th, 2001 *In from the Cold,* New Scientist *cf.* p. 47; Sarah Simpson, *Thawing Scott's Legacy*, December 2001, Scientific American Magazine; David W. H. Walton, Review of *The Coldest March: Scott's Fatal Antarctic Expedition*, by Susan Solomon, Polar Record **39**(2003)80–81; Paul Cooper, *Scott's Icy Death*, Nature, Nov. 9th, 1999.

46 http://www.theguardian.com/books/2001/oct/07/historybooks.highereducation

47 Susan Solomon, *The Coldest March: Scott's Fatal Antarctic Expedition*, Yale University Press, New Haven and London, 2001, *cf.* p. 74.

48 *Ibid.*, *cf.* p. 154.

49 *Ibid.*, *cf.* p. 292.

50 *Ibid.*, *cf.* p. 164.

51 *Loc. cit.*

52 *Ibid.*, *cf.* p. 288.

53 George C. Simpson, *British Antarctic Expedition, 1910–1913, Meteorology*, Vol. I, *Discussion*, Thacker, Spink, and Co., Calcutta, 1919, *cf.* p. 31.

54 Susan Solomon, *The Coldest March: Scott's Fatal Antarctic Expedition*, Yale University Press, New Haven and London, 2001, *cf.* p. 161.

55 Edward R. G. R. Evans, *South with Scott*, Collins, London, 1921, *cf.* p. 130.

56 George C. Simpson, *Meteorology*, Vol. III, *Tables*, Harrison and Sons, Ltd., London, 1923, *cf.* p. 614

57 *Loc. cit.*

58 Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R.F. Scott*, *R.N., C.V.O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 336.

59 Susan Solomon, *The Coldest March: Scott's Fatal Antarctic Expedition*, Yale University Press, New Haven and London, 2001, *cf.* p. 214.

60 Roald Amundsen, *The South Pole: An Account of the Norwegian Antarctic Expedition in the Fram*, Vol. I and II, John Murray, London, 1912, Vol. II, *cf.* p. 372 and 374.

61 Roald Amundsen, *The South Pole: An Account of the Norwegian Antarctic Expedition in the Fram*, Vol. I and II, John Murray, London, 1912.

62 Roland Huntford, *Race for the South Pole: The Expedition Diaries of Scott and Amundsen*, Continuum, London, 2010.

63 See the caption for Fig. 4.10.

64 Susan Solomon, *The Coldest March: Scott's Fatal Antarctic Expedition*, Yale University Press, New Haven and London, 2001, *cf.* p. 316, line 6 from the top.

65 *Ibid.*, *cf.* p. 215.

66 Ben Liblit, *Cooperative Bug Isolation: Winning Thesis of the 2005 ACM Doctoral Dissertation Competition (Lecture Notes in Computer Science / Programming and Software Engineering)*, Springer, 2007, *cf.* p. 55. See also Richard Wiseman, *The Luck Factor*, various editions.

67 Peter L. Bernstein, *Against the Gods: The Remarkable Story of Risk*, J. Wiley & Sons, New York, 1996, *cf.* p. 197.

68 Amos Tversky and Daniel Kahneman, *Belief in the Law of Small Numbers*, Psychological Bulletin **76**(1971)105–110; Daniel Kahneman, *Thinking, Fast and Slow*, Farrar, Straus and Giroux, New York, 2011; Jerome R Busemeyer, Emmanuel M. Pothos, Riccardo Franco and Jennifer S. Trueblood, *A Quantum Theoretical Explanation for Probability Judgment Errors*, Psychological Review **118**(2011)193–218.

69 T. Gilovich, D. Griffin and D. Kahneman, (Eds.), *Heuristics and Biases: The Psychology of Intuitive Judgment*, Cambridge University Press, Cambridge, 2002.

70 Amos Tversky and Daniel Kahneman, *Belief in the Law of Small Numbers*, Psychological Bulletin **76**(1971)105–110.

71 W. Bortkiewicz, *Das Gesetz der kleinen Zahlen*, von T. B. Taubner, Leipzig, 1898. Here, I am not referring to the law of small numbers as it was invented and discussed in 1898 by Bortkiewicz.

72 J. Sundali and R. Croson, *Biases in Casino Betting: The Hot Hand and the Gambler's Fallacy*, Judgment and Decision Making **1**(2006)112; P. Ayton and I. Fisher, *The Hot Hand Fallacy and the Gambler's Fallacy: Two Faces of Subjective Randomness?*, Memory & Cognition **32**(2004)1369–1378; B.D. Burns and B. Corpus, *Randomness and Inductions From Streaks: Gambler's Fallacy Versus Hot Hand*, Psychonomic Bulletin & Review **11**(2004)179–184; T. Gilovich, R. Vallone and A. Tversky, *The Hot Hand in Basketball: On The Misperception of Random Sequences*, Cognitive Psychology **17**(1985)295–314; D. Kahneman and A. Tversky, *Subjective Probability: A Judgment of Representativeness*. Cognitive Psychology **3**(1972)430–454; G. Gigerenzer, *Surrogates for Theories*, in G. Gigerenzer (Ed.), *Adaptive Thinking: Rationality in the Real World*, *cf.* p. 289–296, Oxford University Press, Oxford, 2000, *cf.* p. 289–296; V. Ariyabuddhiphongs, *Lottery Gambling: A Review*, J. Gambl. Stud., http://walkerd.people.cofc.edu/360/AcademicArticles/LotteryReviewJGS.pdf.

73 J. Strzałko, J. Grabski, A. Stefański, P. Perlikowski and T. Kapitaniak, *Dynamics of Coin Tossing is Predictable*, Physics Reports **469**(2008)59–92. See also http://www.random.org/coins/

74 Susan Solomon, *The Coldest March: Scott's Fatal Antarctic Expedition*, Yale University Press, New Haven and London, 2001, *cf.* p. 102.

75 Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R.F. Scott, R.N., C.V.O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 50.

76 Ibid., *cf.* p. 61.

77 Susan Solomon, *The Coldest March: Scott's Fatal Antarctic Expedition*, Yale University Press, New Haven and London, 2001, *cf.* p. 102.

78 Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R.F. Scott, R.N., C.V.O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 130.

79 See, for example, the splendid review by Michael Pearson, *Sledges and Sledging in Polar Regions*, Polar Record **31**(1995)3–24.

80 Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R.F. Scott, R.N., C.V.O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 337.

81 *Ibid.*, *cf.* p. 416.

82 Susan Solomon, *The Coldest March: Scott's Fatal Antarctic Expedition*, Yale University Press, New Haven and London, 2001, *cf.* p. 178.

83 *Loc. cit.*

84 *Loc. cit.*

85 *Ibid.*, *cf.* p. 179.

86 Roland Huntford, *Race to the South Pole: The Expedition Diaries of Scott and Amundsen*, Continuum, London, 2010, *cf.* p. 171.

87 Susan Solomon, *The Coldest March: Scott's Fatal Antarctic Expedition*, Yale University Press, New Haven and London, 2001, *cf.* p. 179.

88 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. II, *cf.* p. 546.

89 Roald Amundsen, *The South Pole: An Account of the Norwegian Antarctic Expedition in the Fram*, Vol. I and II, John Murray, London, 1912, Vol. II, *cf.* p. 393.

90 An analysis of wind events using the Hilbert transform would be helpful in answering this question.

91 Albert Hammond, *It Never Rains in Southern California*, 1972. www.alberthammond.com/song.php?id=105

92 Roland Huntford, *Race to the South Pole: The Expedition Diaries of Scott and Amundsen*, Continuum, London, 2010, *cf.* p. 164 and 166 respectively.

93 *Ibid.*, *cf.* p. 160.

94 Claus Beisbart and Stephan Hartmann, *Probabilities in Physics*, Oxford University Press, Oxford, 2011; Yemima Ben-Menahem and Meir Hemmo (Eds.), *Probability in Physics*, Springer, Heidelberg, 2012.

95 Merriam-Webster.

96 Susan Solomon, *The Coldest March: Scott's Fatal Antarctic Expedition*, Yale University Press, New Haven and London, 2001, *cf.* p. 290.

97 PNAS, *cf.* p. 13014.

98 The observer should notice that in the result –23.3 ± 0.6°F, the ± 0.6°F stands for standard deviation (SD) of my digitalization of Dr Solomon's figure 49 on page 214. The digitization was performed to ensure several dozen independent reading of each data point on Dr Solomon's figure. This procedure of calculating a SD is sound statistical methodology.

99 Not all temperatures reported by Captain Scott for the period from Jan. 13th through Jan. 23rd, 1912 are minimum temperatures. The lowest instead minimum temperatures were reported on Jan. 17th (–23.6°F) and Jan. 21st (–29.7°F).

100 Susan Solomon, *The Coldest March: Scott's Fatal Antarctic Expedition*, Yale University Press, New Haven and London, 2001, *cf.* p. 301.

101 http://www.telegraph.co.uk/topics/weather/9055933/Snow-to-fall-in-London-as-bitterly-cold-weather-grips-Britain.html

102 http://www.bbc.co.uk/news/world-europe-16897068

103 Michael Shermer, *Why People Believe Weird Things: Pseudoscience, Superstition, and Other Confusions of our Time*, W. H. Freeman and Company, New York, 1997, *cf.* p. 49.

104 *Ibid.*, *cf.* p. 301.

105 *Ibid.*, *cf.* p. 303.

106 *Loc. cit.*

107 For a full list of *El Niño* years, see for example: http://www.elnino.noaa.gov/ or http://apollo.lsc.vsc.edu/classes/met130/notes/chapter10/elnino.html
108 Stanisław Lem, *A Perfect Vacuum*, Northwestern University Press, Evanston, 1999 (originally published in Polish in 1971).
109 Susan Solomon, *The Coldest March: Scott's Fatal Antarctic Expedition*, Yale University Press, New Haven and London, 2001, *cf.* p. 299.
110 Professor Gumański's latest book, titled *Istnienie i Logika* (*Entity and Logic*) is the most enlightening summary of his lifetime's work. [Leon Gumański, *Istnienie i Logika*, N. Copernicus University Press, Toruń, 2006.]
111 Susan Solomon, *The Coldest March: Scott's Fatal Antarctic Expedition*, Yale University Press, New Haven and London, 2001, *cf.* p. 278.
112 *Ibid.*, *cf.* p. 275.
113 *Ibid.*, *cf.* p. 299, line 20 from the top.
114 *Ibid.*, *cf.* p. 299, line 3 from the top.
115 *Ibid.*, *cf.* p. 298, line 11 from the bottom.
116 *Ibid.*, *cf.* p. 297, line 15 from the top.
117 *Ibid.*, *cf.* p. 299, line 13 from the bottom.
118 St. Augustine, *De Genesi ad Litteram* (*The Literal Meaning of Genesis*), Book II, xviii, 37.
119 Susan Solomon, *The Coldest March: Scott's Fatal Antarctic Expedition*, Yale University Press, New Haven and London, 2001, *cf.* p. 278, line 7 from the top. See also *cf.* p. 111 and 222.
120 *Ibid.*, *cf.* p. 173.
121 *Ibid.*, *cf.* p. 297, line 9 from the top.
122 *Ibid.*, *cf.* p. 278, line 15 from the top.
123 *Ibid.*, *cf.* p. 285.
124 From the *Message to the Public*.
125 Susan Solomon, *The Coldest March: Scott's Fatal Antarctic Expedition*, Yale University Press, New Haven and London, 2001, *cf.* p. 274, line 5 from the top.
126 Merriam-Webster.
127 Susan Solomon, *The Coldest March: Scott's Fatal Antarctic Expedition*, Yale University Press, New Haven and London, 2001, *cf.* p. 125, line 3 from the bottom.
128 http://www.plymouthherald.co.uk/nightmare-polar-christmas/story-14228017-detail/story.html
129 http://www.culture24.org.uk/science-and-nature/art381541
130 http://en.wikipedia.org/wiki/Occultation
131 William H. Pickering, *The Lunar Atmosphere and the Recent Occultation of Jupiter*, Astronomy & Astrophysics, Carleton College Goodsell Observatory **11**(1892)778.
132 *Loc. cit.*
133 Cornelia Lüdecke, *Tragic Outcome of Extreme Conditions*, Nature **414**(2001)150–151.
134 [The exact wording is] The Nobel Peace Prize for 2007 was awarded to the Intergovernmental Panel on Climate Change (IPCC) and Mr. Albert Gore, Junior. As co-chair of IPCC Working Group One, Susan Solomon led the process that produced the highly influential IPCC Working Group One Fourth Assessment Climate Science Report [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.), *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change,* Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 2007.
135 B. A. Riffenburgh, *The Coldest March: Scott's Fatal Antarctic Expedition*, Endeavour **26**(2002)78–79.

136 http://www.rsc.org/ConferencesAndEvents/RSCEvents/chemistry-centre/event-videos/coldest-march-scott-antarctic-exhibition.asp One can also consult http://www.youtube.com/watch?v=5LoWsLqcizA

137 Krzysztof Sienicki, *A Note on Several Meteorological Topics Related to Polar Regions, Problemy Klimatologii Polarnej* (*The Issues of Polar Meteorology*) **21**(2011)39–76. http://ocean.am.gdynia.pl/p_k_p/prob_011.html [Original link to my work has been changed and one has to follow: http://klimat.org.pl/pkp/pkp_21/Sienicki-pkp21.pdf or http://klimat.org.pl/pkp/prob_011.html]

138 http://scienceandpublicpolicy.org/images/stories/papers/originals/comments_dr_richard.pdf

139 Recording time about 55:25.

140 Recording time about 1:08:31.

141 http://news.bbc.co.uk/2/hi/science/nature/1535989.stm;
https://web.archive.org/web/20030823001618/http://chronicle.com/free/v48/i02/02a02001.htm;
http://www.telegraph.co.uk/comment/4265812/Scott-in-from-the-cold.html

Chapter 5: Historical Scrutiny of Meteorological Record of *Terra Nova Expedition*

pages 213 through 240

1 A Latin saying that is ascribed to Petronius – The world wants to be deceived, so let it be deceived.

2 Stanisław Lem, *The Star Diaries*, various editions since 1957. Originally published in Polish and after in 41 languages including English.

3 Max Jones (Ed.), *Journals: Captain Scott's Last Expedition*, Oxford University Press, Oxford, 2006.

4 Ranulph Fiennes, *Captain Scott,* Hodder & Stoughton, London, 2003, *cf.* p. xiii.

5 Stephen Gwynn, *Captain Scott*, John Lane, London, 1929; George Seaver, *Scott of the Antarctic*, John Murray, London, 1940; Harry Ludlam, *Captain Scott: The Full Story*, Foulsham, London, 1965; Reginald Pound, *Scott of the Antarctic,* Cassell, London, 1966; Elspeth Huxley, *Scott of the Antarctic*, Weidenfeld & Nicolson, London, 1977; Roland Huntford, *Scott and Amundsen,* Hodder & Stoughton, London, 1979; Michael De-la-Noy, *Scott of the Antarctic,* Sutton Publishing, London, 1997; Ranulph Fiennes, *Captain Scott,* Hodder & Stoughton, London, 2003.

6 David Crane, *Scott of the Antarctic, A Life of Courage and Tragedy*, Alfred A. Knopf, New York, 2006.

7 http://www.bbc.com/news/magazine-15384729

8 Nickname of Dr George C. Simpson.

9 Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R.F. Scott*, *R.N., C.V.O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 297.

10 *Ibid*., *cf.* p. 130.

11 Roland Huntford, *Scott and Amundsen,* Hodder & Stoughton, London, 1979; *Shackleton*, Hodder & Stoughton, London, 1985; *Nansen: The Explorer as Hero,* Duckworth, London, 1997; *Race for the South Pole: The Expedition Diaries of Scott and Amundsen*, Continuum Publishing Corporation, London, 2010.

12 Personal communication (Oct. 8th, 2009) with Roland Huntford.

13 Roland Huntford, *The Last Place on Earth*, Modern Library, New York, 1999, *cf.* p. 516.

14 *Loc cit*.

15 Roland Huntford, *Race for the South Pole: The Expedition Diaries of Scott and Amundsen*, Continuum, London, 2010, *cf.* p. 309.
16 *Loc cit*.
17 *Ibid*., *cf.* p. 307.
18 Ranulph Fiennes, *Cold: Extreme Adventures at the Lowest Temperatures on Earth*, Simon and Schuster, New York, 2013, *cf.* p. 100.
19 Ranulph Fiennes, *Captain Scott*, Hodder and Stoughton, London, 2003, *cf.* p. 405. In the US, Sir Ranulph's book was published under the different title *Race to the Pole: Tragedy, Heroism, and Scott's Antarctic Quest*. I am referencing in this chapter after the British first edition by Hodder and Stoughton.
20 *Ibid*., *cf.* p. 351.
21 E. Shackleton, *South: the Story of Shackleton's Last Expedition*, 1914–1917, The MacMillan Company, New York, 1920, *cf.* p. 177; C. Kharif, E. Pelinovsky and A. Slunyaev, *Rogue Waves in the Ocean*, Springer, 2009; E. Pelinovsky and C. Kharif (Eds.), *Extreme and Rogue Waves*, Nat. Hazards Earth Syst. Sci. (2010) Special Issue. http://www.nat-hazards-earth-syst-sci.net.
22 Ranulph Fiennes, *Captain Scott*, Hodder and Stoughton, London, 2003, *cf.* p. ix.
23 *Ibid*., *cf.* p. 352.
24 George C. Simpson, *Meteorology*, Vol. III, *Tables*, Harrison and Sons, Ltd., London, 1923, *cf.* p. 670.
25 *Ibid*., *cf.* p. 642.
26 Ranulph Fiennes, *Captain Scott*, Hodder and Stoughton, London, 2003, *cf.* p. 363.
27 Randall J. Osczevski, *The Basis of Wind Chill*, Arctic **48**(1995)372–382.
28 Ranulph Fiennes, *Captain Scott*, Hodder and Stoughton, London, 2003, *cf.* p. 318.
29 *Ibid*., *cf.* p. 353.
30 *Ibid*., *cf.* p. ix.
31 *Ibid*., *cf.* p. 352.
32 Susan Solomon's PNAS article and *The Coldest March*.
33 https://www.hodder.co.uk/books/detail.page?isbn=9780340826997
34 https://www.youtube.com/watch?v=iVyxaqYz5YM
35 http://www.menshealth.co.uk/living/men/emmhem-interview-sir-ranulph-fiennes-490190#image-7
36 Ranulph Fiennes, *Captain Scott*, Hodder and Stoughton, London, 2003, *cf.* p. 362.
37 George C. Simpson, *Meteorology*, Vol. III, *Tables*, Harrison and Sons, Ltd., London, 1923, *cf.* p. 642.
38 Ranulph Fiennes, *Captain Scott*, Hodder and Stoughton, London, 2003, *cf.* p. 351.
39 *Ibid*, *cf.* p. 352.
40 Colin Bull and Pat F. Wright (Eds.), *Silas: The Antarctic Diaries and Memoir of Charles S. Wright*, Ohio State University Press, 1992, *cf.* p. 373.
41 George C. Simpson, *Scott's Polar Journey and The Weather*, Halley Lecture delivered on May 17th, 1923, Clarendon Press, Oxford, 1926.
42 Gabrielle Walker, *In from the Cold* – interview with Susan Solomon, New Scientist, Oct. 13th, 2001, *cf.* p. 47.
43 Ranulph Fiennes, *Captain Scott*, Hodder and Stoughton, London, 2003, *cf.* p. 362.
44 *Ibid*., *cf.* p. 353.
45 *Ibid*., *cf.* p. 263.
46 Admiral Sir E. R. G. Evans, *How the Sailor Looks at the Surgeon and the Medical Aspects of Polar Exploration from a Sailor-explorer's Viewpoint*, Journal of the Royal Naval Medical Service **23**(1937)14–30.

[47] Ranulph Fiennes, *Cold: Extreme Adventures at the Lowest Temperatures on Earth*, Simon and Schuster, New York, 2013.
[48] *Ibid.*, *cf.* p. 299–332.
[49] *Ibid.*, *cf.* p. 328.
[50] Yottabyte = 10^{24} bytes. In 2010, it was estimated that storing a yottabyte on terabyte-size hard drives would require one million city block size datacenters, as big as the states of Delaware and Rhode Island combined, after http://gizmodo.com/5557676/how-much-money-would-a-yottabyte-hard-drive-cost
[51] Krzysztof Sienicki, *The Weather and its Role in Captain Robert F. Scott and his Companions' Deaths*. http://arxiv.org/abs/1011.1272
[52] Krzysztof Sienicki, *A Note on Several Meteorological Topics Related to Polar Regions*, Issues of Polar Climatology **21**(2011)39–76. http://ocean.am.gdynia.pl/p_k_p/pkp_21/Sienicki-pkp21.pdf [Original link to my work has been changed and one has to follow: http://klimat.org.pl/pkp/pkp_21/Sienicki-pkp21.pdf or http://klimat.org.pl/pkp/prob_011.html]
[53] http://orwell.ru/library/essays/nationalism/english/e_nat
[54] Max Jones, *The Last Great Quest: Captain Scott's Antarctic Sacrifice*, Oxford University Press, Oxford, 2003.
[55] Stephanie Barczewski, *Antarctic Destinies: Scott, Shackleton, and the Changing Face of Heroism*, Hambledon Continuum, London, 2007.
[56] *Ibid.*, *cf.* p. 306.
[57] *Loc. cit*.
[58] *Ibid.*, *cf.* p. 85.
[59] *Ibid.*, *cf.* p. 336.
[60] Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. II, *cf.* p. 419.
[61] Stephanie Barczewski, *Antarctic Destinies: Scott, Shackleton, and the Changing Face of Heroism*, Hambledon Continuum, London, 2007, *cf.* p. 85.
[62] Max Jones, *The Last Great Quest: Captain Scott's Antarctic Sacrifice*, Oxford University Press, Oxford, 2003, *cf.* p. 116.
[63] Max Jones (ed.), *Journals: Captain Scott's Last Expedition*, Oxford University Press, Oxford, 2006, *cf.* p. 498.
[64] http://amrc.ssec.wisc.edu/aws/index.php?region=Ross%20Ice%20Shelf&year=2012
[65] Max Jones, *The Last Great Quest: Captain Scott's Antarctic Sacrifice*, Oxford University Press, Oxford, 2003, *cf.* p. 117.
[66] *Ibid.*, *cf.* p. 116.
[67] *Ibid.*, *cf.* p. 117.
[68] *Ibid.*, *cf.* p. 116.
[69] David Crane, *Scott of the Antarctic, A Life of Courage and Tragedy*, Alfred A. Knopf, New York, 2006.
[70] *Ibid.*, *cf.* p. 11.
[71] *Ibid.*, *cf.* p. 516.
[72] *Loc. cit*.
[73] *Ibid.*, *cf.* p. 547.
[74] *Ibid*, Caroline Alexander's comment at back-of-jacket of the book.
[75] http://eprints.utas.edu.au/2627/
[76] Carl Murray, *The Use and Abuse of Dogs on Scott's and Amundsen's South Pole Expeditions*, Polar Record **44** (2008)303–310.
[77] *Ibid*, *cf.* p. 304.
[78] Sarah L. Wilks, *The Coldest Dog and Pony Show on Earth: Animal Welfare on the First Expeditions to Reach the South Pole*, Anthrozoös **25**(2012)93–109.

79 http://eprints.utas.edu.au/2627/, *cf.* p. 83.
80 http://eprints.utas.edu.au/2627/, *cf.* p. 154 & 155.
81 *Loc. cit.*
82 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922. In the preamble of Chapter XI – *The Polar Journey*, Cherry-Garrard cites Fridtjof Nansen: "People, perhaps, still exist who believe that it is of no importance to explore the unknown polar regions. This, of course, shows ignorance. It is hardly necessary to mention here of what scientific importance it is that these regions should be thoroughly explored. The history of the human race is a continual struggle from darkness towards light. It is, therefore, to no purpose to discuss the use of knowledge; man wants to know, and when he ceases to do so, he is no longer man."
83 http://eprints.utas.au/2627/, *cf.* p. 155
84 Gary Taubes, *Bad Science: The Short Life and Weird Times of Cold Fusion*, Random House, New York, 1993; see also https://en.wikipedia.org/wiki/Cold_fusion
85 James McBride, *Symmes's Theory of Concentric Spheres: Demonstrating that the Earth is Hollow, Habitable within, and widely Open about the Poles*, Morgan, Lodge and Fisher, Cincinnati, 1826; M. L. Sherman and William F. Lyon, *The Hollow Globe; or, The World's Agitator and Reconciler: A treatise on the Physical Conformation of the Earth*, Religio-philosophical Publishing House, Chicago, 1871.
86 Roald Amundsen, *The South Pole: An Account of the Norwegian Antarctic Expedition in the Fram*, Vol. I and II, John Murray, London, 1912, Vol. II, *cf.* p. 76.

Chapter 6: Meteorological Data and Weather Forecasting

pages 241 through 273

1 A. Conan Doyle, *The Sign of the Four: The Science of Deduction*, numerous editions.
2 A. Conan Doyle, *The Adventures of Sherlock Holmes: A Scandal in Bohemia*, numerous editions.
3 Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R.F. Scott, R.N., C.V.O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913; Jan. 4th, 1911 entry, *cf.* p. 61.
4 *Ibid.*, *cf.* p. 62.
5 http://www.usap.gov/videoclipsandmaps/mcmwebcam.cfm
6 George C. Simpson, *British Antarctic Expedition, 1910–1913, Meteorology*, Vol. I, *Discussion*, Thacker, Spink, and Co., Calcutta, 1919, *cf.* p. 6.
7 *Loc. cit.*
8 George C. Simpson, *Meteorology*, Vol. III, *Tables*, Harrison and Sons, Ltd., London, 1923, *cf.* p. 20.
9 George C. Simpson, *Meteorology*, Vol. III, *Tables*, Harrison and Sons, Ltd., London, 1923.
10 George C. Simpson, *British Antarctic Expedition, 1910–1913, Meteorology*, Vol. I, *Discussion*, Thacker, Spink, and Co., Calcutta, 1919, *cf.* p. 15.
11 *Ibid.*, *cf.* p. 10.
12 *Ibid.*, *cf.*, p. 15.
13 Albert Johnson, *Abolish the Fahrenheit Thermometer: Speech Hon. Albert Johnson House of Representatives, December 14, 1915*, Government Printing Office, Washington, 1916. Hon. Johnson's speech and the House bill 528 was supported by the letters of many distinguished Americans. Besides them was a Polish meteorologist Henryk Arctowski, who served in Adrian de Gerlache de Gomery's *Belgica Expedition* (1897–1899). At the time of

Johnson's address, Dr Henryk Arctowski was directing the natural sciences division at the NY Public Library. In the letter to hon. Johnson, Dr Arctowski observed "Any well-educated person having at heart the progress of this country must join you in the desire of having the Fahrenheit scale of temperature abolished." Page 7 of Johnson speech. Interestingly, Dutch physicist Daniel Gabriel Fahrenheit was born in Gdańsk, Poland where some three hundred years later I received my PhD in physics. The house in which he was born is located at Ogarna 95 Street in Gdańsk, Poland, and its façade presents a Fahrenheit thermometer and brief information about it.

14 George C. Simpson, *British Antarctic Expedition, 1910–1913, Meteorology*, Vol. I, *Discussion*, Thacker, Spink, and Co., Calcutta, 1919, *cf.* p. 15.

15 T. Griffith Taylor, *With Scott: The Silver Lining*, Smith, Elder & Co., London, 1916, *cf.* p. 237.

16 W. N. Shaw, *Meteorology: National Antarctic Expedition 1901–1904, Part I: Observations at Winter Quarters and on Sledge Journeys*, Royal Society, London, 1908, *cf.* p. 8.

17 *Ibid*., *cf*., p. 237.

18 George C. Simpson, *British Antarctic Expedition, 1910–1913, Meteorology*, Vol. I, *Discussion*, Thacker, Spink, and Co., Calcutta, 1919, *cf.* p. 17.

19 *Ibid*., *cf.* p. 19.

20 *Loc. cit*.

21 Henry G. Madan, *An Elementary Treatise on Heat*, Rivingtons, London, 1889, *cf*., p. 232.

22 For a detailed analytical examination, see Chapter 13 of John L. Monteith and Mike Unsworth, *Principles of Environmental Physics*, Elsevier Science, Amsterdam, 2007.

23 W. N. Shaw, *Meteorology: National Antarctic Expedition 1901–1904, Part I: Observations at Winter Quarters and on Sledge Journeys*, Royal Society, London, 1908, *cf.* p. 471.

24 George C. Simpson, *British Antarctic Expedition, 1910–1913, Meteorology*, Vol. I, *Discussion*, Thacker, Spink, and Co., Calcutta, 1919, *cf.* p. iv.

25 *Loc. cit*.

26 *Ibid*., p. 18.

27 *Loc. cit*.

28 André Bégin-Drolet, Jean Lemay and Jean Ruel, *Time Domain Modeling of Cup Anemometers Using Artificial Neural Networks*, Flow Measurement and Instrumentation **33**(2013)10–27. Enrique Vega, Santiago Pindado, Alejandro Martínez, Encarnación Meseguer and Luis García, *Anomaly Detection on Cup Anemometers*, Measurement Science and Technology **25**(2014)127002–127007.

29 George C. Simpson, *British Antarctic Expedition, 1910–1913, Meteorology*, Vol. I, *Discussion*, Thacker, Spink, and Co., Calcutta, 1919, *cf.* p. 94.

30 http://amrc.ssec.wisc.edu/aws/

31 George C. Simpson, *British Antarctic Expedition, 1910–1913, Meteorology*, Vol. I, *Discussion*, Thacker, Spink, and Co., Calcutta, 1919, *cf.* p. iv–iiv.

32 Susan Solomon, *The Coldest March: Scott's Fatal Antarctic Expedition*, Yale University Press, 2001, *cf.* p. 289.

33 George C. Simpson, *British Antarctic Expedition, 1910–1913, Meteorology*, Vol. I, *Discussion*, Thacker, Spink, and Co., Calcutta, 1919, *cf*., *cf.* p. 17.

34 Matthew A. Lazzara, George A. Weidner, Linda M. Keller, Jonathan E. Thom and John J. Cassano, *Antarctic Automatic Weather Station Program: 30 Years of Polar Observation*, Bulletin of the American Meteorological Society **93** (2012)1519–1537. Sadly, the authors of this technical publication misrepresented Captain Scott's work in Antarctica and promoted Drs Solomon and Stearns' fallacious work. For a short critical account on this issue, see my paper, http://arxiv.org/abs/1305.5508 Needless to say, the editor of Bulletin of the American Meteorological Society, Jeff Rosenfeld, for many different unfounded con-

junctions did not find it important enough to publish my critical note on Lazzara *et al*. misinterpretation. For an instructive example of the reluctance of peer-reviewed journals to publish any corrections by people who are not the original authors, see http://julianstirling.co.uk/how-can-we-trust-scientific-publishers-with-our-work-if-they-wont-play-fair/

35 Devid B. Reusch and Richard B. Alley, *Automatic Weather Stations and Artificial Neural Networks: Improving the Instrumental Record in West Antarctica*, Mon. Weather Rev. **130**(2002)3037–3053.

36 Isaac Asimov, *I, robot*, numerous editions.

37 George C. Simpson, *Scott's Polar Journey and The Weather*, Halley Lecture delivered on May 17th, 1923, Clarendon Press, Oxford, 1926, *cf.* p. 23.

38 Charles Chree and Napier Shaw, *Meteorological Glossary*, Great Britain Meteorological Office, H. M. Stationery, London, 1918, *cf.* p. 58.

39 http://www.pnas.org/content/107/43/18354.full.pdf

40 Spencer R. Weart, *The Discovery of Global Warming: Revised and Expanded Edition*, Harvard University Press, 2008.

41 Interestingly, this pitiable report for the Proceedings National Academy of Sciences (USA) was edited by Dr James E. Hansen, Goddard Institute for Space Studies, New York, the same person who edited the equally unscientific and fallacious "paper" by Dr Solomon and Dr Stearns, as I discussed in great detail in Chapter 4. http://www.pnas.org/misc/iforc.shtml Dr Solomon *et al*.'s 1000 years prediction power was just recently over passed by Dr Richard E. Zeebe, who extended his predictive power to 10000 years [*sic*] into the future. See Fig. 1 and 2 in his "paper" published – of course – in the Proceedings National Academy of Sciences (USA), Richard E. Zeebe, *Time-dependent Climate Sensitivity and the Legacy of Anthropogenic Greenhouse Gas Emissions*, Proceedings of the National Academy of Sciences **110**(2013)13739–13744. http://www.pnas.org/content/110/34/13739.full.pdf Who's next to beat this forecast?

42 http://rogerjnorton.com/Lincoln78.html

43 Bertrand Russel, *Our Knowledge of the External World as a Field for Scientific Method in Philosophy*, The Open Court Publishing Company, Chicago, 1914, *cf.* p. 232.

44 http://www.math.uvic.ca/faculty/diacu/diacuNbody.pdf

45 Ian Roulstone and John Newbury, *Invisible in the Storm: The Role of Mathematics in Understanding the Weather*, Princeton University Press, Princeton, 2013, *cf.*, p. 271; Chapter 8 – *Predicting in the Presence of Chaos*.

46 Bruno de Finetti, *Theory of Probability*, John Wiley and Sons, New York, Vol. 1, 1990, *cf.*, p. x (Preface). For a comprehensive review, the investigative reader may consult Donald Gillies, *Philosophical Theories of Probability*, Routledge, 2012.

47 Herbert I. Weisberg, *Willful Ignorance: The Mismeasure of Uncertainty*, Wiley-Blackwell, Hoboken, 2014.

48 John Newbury and Ian Roulstone (Eds.), *Large-scale Atmosphere-ocean Dynamics*, Cambridge University Press, Cambridge, 2002, Vol. I, *cf.* p. xiii.

49 Laplace as translated in Nagel 1961, *cf.* p. 281–282.

50 Adam Smith, *An Inquiry into the Nature and Causes of the Wealth of Nations*, E. Cannan (Ed.), The University of Chicago Press, Chicago 1976, *cf.* p. 18.

51 „God in the beginning formed matter in solid, massy, hard, impenetrable moveable particles …; no ordinary power being able to divide what God himself made one in the first creation" Isaac Newton, *Optics*, London, Fourth Edition, 1730. Reprinted by Dover, New York, 1952.

52 N. G. Van Kampen, *Determinism and predictability*, Synthese **89**(1991)273–281.

53 Ilya Prigogine, *The End of Certainty: Time, Chaos and the New Laws of Nature*, The Free Press, New York, 1996.

54 Richard P. Feynman, *The Character of Physical Laws*, Modern Library, New York, 1994.
55 Francis Crick, *The Astonishing Hypothesis: The Scientific Search for the Soul*, Simon and Schuster, New York, 1994.
56 D. Angluin and C. H. Smith, *Inductive Inference: Theory and Methods*, Comp. Surveys **15**(1983)237–269.
57 Fridtjof Nansen, *The Structure and Combination of the Histological Elements of the Central Nervous System*, J. Grieg, Bergen, 1887, *cf.* p. 147. Roland Huntford in *Nansen: The Explorer as Hero*, Abacus, London, 1997 on p. 68 cites the following "We are obliged to abandon the theory of the direct combination of the [nerve] cells".
58 Donald O. Hebb, *The Organization of Behaviour: A Neurophysiological Theory*, Wiley, New York, 1949.
59 Morris H. Baslow, *The Languages of Neuron: An Analysis of Coding Mechanisms by Which Neuron Communicate, Learn and Store Information*, Entropy **11**(2009)782–797; Fang-Chin Yeh *et. al.*, *Maximum Entropy Approaches to Living Neural Networks*, Entropy **12**(2010)89–106.
60 *2001: A Space Odyssey*, directed by S. Kubrick, written by Arthur C. Clarke and S. Kubrick, 1968. "I am continually annoyed by careless references to "*The Sentinel*" as "the story on which 2001 is based"; it bears about as much relation to the movie as an acorn to the resultant full-grown oak." From Arthur C. Clarke in *The Sentinel: Masterworks of Science Fiction and Fantasy*, Berkley Books, New York, 1983, *cf.* p. 88.
61 Mary W. Shelley, *Frankenstein or the Modern Prometheus*, G. Routledge and Sons, London, 1888, *cf.* p. 315.
62 A. M. Turing, *Computing Machinery and Intelligence*, Mind 59 no.236, 1950; reprinted in *The Minds's I*, D. R. Hofstadter and D. C. Dennet, Basic Books, Inc., Penguin Books, Harmondsworth, Midds., 1981.
63 Keith J. Holyoak and Robert J. Morrison, (Eds.), *The Cambridge Handbook of Thinking and Reasoning*, Cambridge University Press, Cambridge, 2005.
64 J. Androsiuk, L. Kułak and K. Sienicki, *Neural Network Solution of the Schrödinger Equation for a Two-dimensional Harmonic Oscillator*, Chem. Phys. **173**(1993)377–382.
65 Zhigang Zeng and Jun Wang, (Eds.), *Advances in Neural Network Research and Applications*, Springer, Berlin, 2010.
66 Yves Chauvin and David E. Rumelhart, (Eds.), *Back-Propagation: Theory, Architecture, and Applications*, Routledge, 1995.

Chapter 7: February 27th through March 27th, 1912 – Extreme Cold Snap?

pages 274 through 307

1 Mark Twain, *Following the Equator: A Journey Around the World*, The Floating Press, 2009, *cf.* p. 567 or many different editions.
2 http://quoteinvestigator.com/2011/11/05/computers-useless/
3 For example Peter Godfrey-Smith, *Theory and Reality: An Introduction to the Philosophy of Science*, University of Chicago Press, Chicago, 2003, *cf.* p. 236; W. Stanley Jevons, *The Principles of Science: A Treatise on Logic and Scientific Method*, MacMillan, London, 1874, *cf.* p. 267. "We go through the same steps as before: (1) We frame an hypothesis, (2) We deduce the probability of various series of possible consequences, (3) We compare the consequences with the particular facts, and observe the probability that such facts would happen under the hypothesis."
4 T. E. Burke, *The Philosophy of Popper*, Manchester University Press, Manchester, 1983, *cf.* p. 51.

5 *The OPERA Collaboration. Measurement of the neutrino velocity with the OPERA detector in the CNGS beam* at arXiv:1109.4897v1 [hep-ex], 2011.
6 For example http://www.nytimes.com/2011/09/24/science/24speed.html
7 Krzysztof Sienicki, *A Note on Several Meteorological Topics Related to Polar Regions*, The Issues of Polar Meteorology **21**(2011)39–76, available at http://ocean.am.gdynia.pl/p_k_p/pkp_21/Sienicki-pkp21.pdf [Original link to my work has been changed and one has to follow: http://klimat.org.pl/pkp/pkp_21/Sienicki-pkp21.pdf or http://klimat.org.pl/pkp/prob_011.html] and http://arxiv.org/abs/1011.1272
8 Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R.F. Scott, R.N., C.V.O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, various pages; George C. Simpson, *Meteorology*, Vol. III, *Tables*, Harrison and Sons, Ltd., London, 1923, *Table 72. Register of Main Polar Party November 3rd, 1911, to March 12th, 1912*, *cf.* p. 618.
9 Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R.F. Scott, R.N., C.V.O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 413.
10 The letter is held by the Scott Polar Research Institute. http://www.mytimemachine.co.uk/scott.htm
11 George C. Simpson, *Scott's Polar Journey and the Weather*, Halley Lecture delivered on May 17th, 1923, Clarendon Press, Oxford, 1926, *cf.* p. 29.
12 *Ibid.*, *cf.* p. 30.
13 Laurens de Haan and Ana Ferreira, *Extreme Value Theory: An Introduction*, Springer, 2006; Jan Beirlant, Yuri Goegebeur, Johan Segers and Jozef Teugels, *Statistics of Extremes: Theory and Applications*, John Wiley & Sons, 2004; Michael Falk, Jürg Hüsler, Rolf-Dieter Reiß and R. D. Reiss, *Laws of Small Numbers: Extremes and Rare Events*, Springer, 2010.
14 B. Podobnik and H. E. Stanley, *Detrended Cross-Correlation Analysis: A New Method for Analyzing Two Non-Stationary Time Series*, Phys. Rev. Lett. **100**(2008)084102; Janusz Miśkiewicz, *Network Analysis of Correlation Strength Between the Most Developed Countries*, http://arxiv.org/pdf/1211.3599.pdf; Jaroslav Hlinka, David Hartman, Martin Vejmelka, Dagmar Novotná, and Milan Paluš, *Non-linear Dependence and Teleconnections in Climate Data: Sources, Relevance, Nonstationarity*, http://arxiv.org/pdf/1211.6688.pdf
15 Alexander I. Galushkin, *Neural Networks Theory*, Springer, Berlin, 2007; Bernard Widrow and Michael A. Lehr, *30 Years of Adaptive Neural Networks: Perceptron, Madaline and Backpropagation*, Proceedings of the IEEE **79**(1990)1415.
16 J. Androsiuk, L. Kułak and K. Sienicki, *Neural Network Solution of the Schrödinger Equation for a Two-dimensional Harmonic Oscillator*, Chem. Phys. **173**(1993)377–383.
17 See the caption of Tab. 7.1 for a list of missing data.
18 Krzysztof Sienicki, *A Note on Several Meteorological Topics Related to Polar Regions*, The Issues of Polar Meteorology **21**(2011)39–76, available at http://ocean.am.gdynia.pl/p_k_p/pkp_21/Sienicki-pkp21.pdf [Original link to my work has been changed and one has to follow: http://klimat.org.pl/pkp/pkp_21/Sienicki-pkp21.pdf or http://klimat.org.pl/pkp/prob_011.html] and http://arxiv.org/abs/1011.1272
19 http://en.wikipedia.org/wiki/Time_in_Antarctica
20 George C. Simpson, *Meteorology*, Vol. III, *Tables*, Harrison and Sons, Ltd., London, 1923, Table 72.
21 *Ibid.*, Tab. 73.
22 *Ibid.*, Tab. 74.
23 *Ibid.*, Tab. 75.

24 *Ibid.*, Tab. 76.
25 E. Kidson, *British Antarctic Expedition 1907–1909: Reports on the scientific investigations: Meteorology*, H. J. Green (Government Printer), Melbourne, 1930.
26 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922.
27 George C. Simpson, *Meteorology*, Vol. III, *Tables*, Harrison and Sons, Ltd., London, 1923, Tab. 76.
28 Including 6 leap years and limited data for 1988 (14 points).
29 George C. Simpson, *British Antarctic Expedition, 1910–1913, Meteorology*, Vol. II, *Weather Maps and Pressure Curves*, Thacker, Spink, and Co., Calcutta, 1919.
30 Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R.F. Scott*, *R.N., C.V.O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 416.
31 Charles Chree and Napier Shaw, *Meteorological Glossary*, H. M. Stationery Office, London, 1918, *cf.* p. 246.
32 From http://amrc.ssec.wisc.edu/aws/index.php?region=Ross%20Ice%20Shelf&station=Schwerdtfeger However, because of the continuous flow of the Ross Ice Shelf, this location is slightly variable.
33 George C. Simpson, *British Antarctic Expedition 1910–1913: Meteorology*, Vol. I, *Discussion*, Thacker, Spink and Co., Calcutta, 1919; Vol. III, *Tables*, Harrison and Sons, Ltd., London, 1923.
34 Susan Solomon, *The Coldest March: Scott's Fatal Antarctic Expedition*, Yale University Press, New Haven, 2001, *cf.* p. 289.
35 Maximilian Schlosshauer, Johannes Kofler and Anton Zeilinger, *A Snapshot of Foundational Attitudes Toward Quantum Mechanics*, http://arxiv.org/abs/1301.1069.
36 Article III. c) scientific observations and results from Antarctica shall be exchanged and made freely available.
37 Krzysztof Sienicki, *A Note on Several Meteorological Topics Related to Polar Regions*, The Issues of Polar Meteorology **21**(2011)39–76, http://ocean.am.gdynia.pl/p_k_p/pkp_21/Sienicki-pkp21.pdf [Original link to my work has been changed and one has to follow: http://klimat.org.pl/pkp/pkp_21/Sienicki-pkp21.pdf or http://klimat.org.pl/pkp/prob_011.html]
38 E. J. Steig, D. P. Schneider, S. D. Rutherford, M. E. Mann, J. C. Comiso and D. T. Shindell, *Warming of the Antarctic ice-sheet surface since the 1957 International Geophysical Year*, Nature **457**(2009)459.
39 Ryan O'Donnell, Nicholas Lewis, Steve McIntyre and Jeff Condon, *Improved Methods for PCA-Based Reconstructions: Case Study Using the Steig et al. (2009) Antarctic Temperature Reconstruction*, J. Climate **24**(2011) 2099–2115.
40 Gilbert T. Walker, *Correlations in Seasonal Variations of Weather, IX. Further Studies of World Weather*, Memoirs of the India Meteorological Department **24**(1923)275–33.
41 *Ibid.*, *cf.* p. 326.
42 See for example: Edward S. Sarachik and Mark A. Cane, *The El Niño-Southern Oscillation Phenomenon*, Cambridge University Press, Cambridge, 2010 and for a slightly less academic account see César N. Caviedes, *El Niño in History: Storming Through the Ages*, University of Florida Press, Gainesville, 2001.
43 Constantino Tsallis, *Introduction to Nonextensive Statistical Mechanics: Approaching a Complex World*, Springer, New York, 2009.
44 Susan Solomon, *The Coldest March: Scott's Fatal Antarctic Expedition*, Yale University Press, 2001, *cf.* p. 303.
45 Charles Chree and Napier Shaw, *Meteorological Glossary*, Printed Under The Authority of His Majesty's Stationery Office by Darling and Son, Limited, London, 1918, *cf.* p. 110.

46 Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R. F. Scott, R. N., C. V. O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, entries at respective dates.
47 George C. Simpson, *British Antarctic Expedition, 1910–1913, Meteorology*, Vol. I, *Discussion*, Thacker, Spink, and Co., Calcutta, 1919, *cf.* p. 20.
48 George C. Simpson, *Meteorology*, Vol. III, *Tables*, Harrison and Sons, Ltd., London, 1923, *cf.* p. 641.
49 George C. Simpson, *British Antarctic Expedition, 1910–1913, Meteorology*, Vol. I, *Discussion*, Thacker, Spink, and Co., Calcutta, 1919.

Chapter 8: March 21st through 29th, 1912 – Never Ending Gale?

pages 308 through 322

1 „This 24-cent airmail stamp from 1918, which was erroneously printed with an inverted centre, is worth about $200,000, about two thousand times the price of a regular copy of the same Stamp". Taken from http://www.simplicitytheory.org/
2 Actually, Mar. 29th, 1912 was Friday and not Thursday.
3 Peter L. Finkelstein, *Measuring the Dynamic Performance of Wind Vanes*, Journal of Applied Meteorology **20**(1981)588–594. Leo J. Fritschen and Gay W. Lloyd, *Wind Speed and Direction*, In Environmental Instrumentation, Springer, New York, 1979, *cf.* p. 164–185.
4 http://www.antarcticanz.govt.nz/scott-base
5 For the meteorological community, and in the Beaufort wind scale, a storm means winds 25–28 m/s! (89–102 km/h).
6 PNAS, *cf.* p. 13016.
7 Scott Huler, *Defining the Wind: The Beaufort Scale, and How a 19th-Century Admiral Turned Science into Poetry*, Three Rivers Press, 2005.
8 George C. Simpson, *The Beaufort Scale of Wind-Force*, Report of the Director of the Meteorological Office, Official No 180, London, 1906; A. C. Chamberlain, *Roughness Length of Sea, Sand, and Snow*, Boundary-Layer Meteorology Volume 25, Number 4, 405–409.
9 George C. Simpson, *British Antarctic Expedition 1910–1913: Meteorology*, Vol. I, *Discussion*, Thacker, Spink and Co., Calcutta, 1919, *cf.* p. 128.
10 http://en.wikipedia.org/wiki/Beaufort_scale
11 R. F. Scott, *Scott's Last Expedition: Being the Journals of Captain R. F. Scott, R. N., C. V. O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 410.
12 http://www.weather.gov/glossary/index.php?letter=b
13 R. F. Scott, *Scott's Last Expedition: Being the Journals of Captain R. F. Scott, R. N., C. V. O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 417.
14 R. F. Scott, *Scott's Last Expedition: Being the Journals of Captain R. F. Scott, R. N., C. V. O.*, Vol. II, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 211.
15 George C. Simpson, *British Antarctic Expedition 1910–1913: Meteorology*, Vol. I, *Discussion*, Thacker, Spink and Co., Calcutta, 1919, *cf.* p. 148.
16 R. F. Scott, *Scott's Last Expedition: Being the Journals of Captain R. F. Scott, R. N., C. V. O.*, Vol. II, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 211.

Volume II

(pages 323 through 460)

Chapter 9: Food, Fuel and Depôts – An Antarctica Menu

pages 325 through 384

1 Roald Amundsen, *My Life as an Explorer*, Doubleday, Page & Co., Garden City. N.Y., *cf.* p. 70.

2 Robert F. Scott, *Message to the Public* in Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R.F. Scott, R.N., C.V.O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 416.

3 Lewis Carroll, *Alice's Adventures in Wonderland*, many different editions.

4 On Feb. 17th, 1911, Captain Scott gave the location of One Ton Depôt at 79°28½′S = –79.475.

5 Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R.F. Scott, R.N., C.V.O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 376.

6 Nov. 1st through Dec. 22nd.

7 Rainer-K. Langner, *Scott and Amundsen: Duel in the Ice*, Haus Publishing, London, 2001, *cf.* p. 169.

8 Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R.F. Scott, R.N., C.V.O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 185.

9 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. I, *cf.* p. 212.

10 *Ibid.*, Vol. II, *cf.* p. 379.

11 *Ibid.*, *cf.* p. 410.

12 Robert E. Feeney, *Polar Journeys: The Role of Food and Nutrition in Early Exploration*, University of Alaska Press and American Chemical Society, Fairbanks, 1997.

13 Edward R. G. R. Evans, *South with Scott*, Collins, London, 1921, *cf.* p. 212.

14 Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R.F. Scott, R.N., C.V.O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 349.

15 *Ibid*, *cf.* p. 394.

16 George C. Simpson, *Meteorology*, Vol. III, Tables, Harrison and Sons, Ltd., London, 1923, *cf.* p. 638.

17 Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R.F. Scott, R.N., C.V.O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 207.

18 *Ibid*, *cf.* p. 352.

19 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. II, *cf.* p. 517.

20 http://trove.nla.gov.au/ndp/del/article/29160640

21 Roald Amundsen, *The South Pole: An Account of the Norwegian Antarctic Expedition in the Fram*, Vol. I and II, John Murray, London, 1912, Vol. II, *cf.* p. 132.

22 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. II, *cf.* p. 395.

23 On page 251, Captain Evans while describing the search for the Captain Scott party gives the following description: "Without any great trouble they reached One Ton Camp on November 10 [1912], having joined forces with the mule party. Dr Atkinson notes that here he found, as we had done before, an oil shortage from paraffin tins in the depôt leaking, although there was no hole discernible. Some stores had been spoilt in consequence."

24 Robert F. Scott, *The Voyage of the 'Discovery'*, Vol. I and II, Toronto: The Copp, Clark Co., London: MacMillan and Co., 1905, *cf.* p. 330.

25 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. II, *cf.* p. 551.

26 Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R.F. Scott, R.N., C.V.O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 440.

27 Robert F. Scott, *Scott's Last Expedition: Being the Reports of the Journeys & the Scientific Work Undertaken by Dr E. A. Wilson and the Surviving Members of the Expedition*, Vol. II, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 345.

28 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, *cf.* p. 550.

29 Thomas Jefferson Randolph (Ed.), *Memoirs, Correspondence, and Private Papers of Thomas Jefferson, Late President of the United States*, Colburn and Bentley, 1829, Vol. II, *cf.* p. 268.

30 Ernest Shackleton, *The Heart of the Antarctic, Being the Story of the British Antarctica Expedition, 1907–1909*, Vol. I & II, W. Heinemann, London, 1909, Vol. I, *cf.* p. 319.

31 See subsection 3.1.2.

32 Gordon E. Fogg, *A History of Antarctic Science*, Cambridge University Press, Cambridge, 1992, *cf.* p. 252.

33 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. II, *cf.* p. 546.

34 http://rsbm.royalsocietypublishing.org/content/52/97

35 Robert J. Tingey, *Heroic Age Geology in Victoria Land, Antarctica*, Polar Record **21**(1983)451–457.

36 R. E. Priestley and C. E. Tilley, *Geological Problems of Antarctica*, in W. L. G. Jorg (Ed.), *Problems of Polar Research: A Series of Papers by Thirty-one Authors*, American Geographical Society, 1928, *cf.* p. 315–328.

37 A. C. Seward, *Antarctic Fossil Plants; British Antarctic Terra Nova Expedition, 1910*: Natural History Report. British Museum Natural History, Geology, 1(1), 1–49, 1914.

38 http://orwell.ru/library/essays/nationalism/english/e_nat

39 W. N. Edwards, *The Occurrence of Glossopteris in the Beacon Sandstone of Ferrar Glacier, South Victoria Land*, Geological Magazine **65**(1928)323–27.

40 https://web.archive.org/web/20120401220616/http://www.nhm.ac.uk/about-us/news/2012/march/spirit-of-scott-team-united-with-rocks-from-epic-expedition109265.html

41 E. A. Newell Arber, *Catalogue of the Fossil Plants of the Glossopteris Flora in the Department of Geology*, British Museum (Natural History), London, 1905; A. C. Seward, *Antarctic Fossil Plants; British Antarctic Terra Nova Expedition, 1910*: Natural History Report. British Museum Natural History, Geology, 1(1), 1–49, 1914; Griffith Taylor, *Physiography and Glacial Geology of East Antarctica*, The Geographical Journal **44**(1914)365–382; T. Griffith Taylor, *Antarctic Adventure and Research*, D. Appleton and Co., New York and London, 1930; T. W. E. David and R. E. Priestley, *Glaciology, Physiography, Stratigraphy and Tectonic Geology of South Victoria Land, British Antarctica Expedition, 1907–09, Reports on the Scientific Investigations, Geology*, W. Heinemann, London, 1914; and papers cited in

Robert J. Tingey, *Heroic Age Geology in Victoria Land, Antarctic*, Polar Record **21**(1983)451–457.

42 Henry R. Frankel, *The Continental Drift Controversy*, Cambridge University Press, Cambridge, 2012.

43 Peter B. Medawar, *Advice to a Young Scientist*, Basic Books, 2008, *cf.* p. 102.

44 Ibid., *cf.* p. 40.

45 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. II, *cf.* p. 546.

46 Cited after Gordon E. Fogg, *A History of Antarctic Science*, Cambridge University Press, Cambridge, 1992, *cf.* p. 252.

47 *Ibid*., *cf.* p. 39.

48 Robert J. Tingey, *Heroic Age Geology in Victoria Land, Antarctica*, Polar Record **21**(1983)451–457.

49 Tom Griffiths, *Slicing the Silence: Voyaging to Antarctica*, Harvard University Press, 2007, *cf.* p. 17 and 79.

50 David Beerling, *The Emerald Planet: How Plants Changed Earth's History*, Oxford University Press, New York, 2007.

51 *Ibid*., *cf.* p. 121.

52 A. C. Seward, *Antarctic Fossil Plants; British Antarctic Terra Nova Expedition, 1910*: Natural History Report. British Museum Natural History, Geology, 1(1), 1–49, 1914, *cf.* p. 42.

53 *Ibid*., *cf.* p. 44.

54 Tom Griffiths is a Professor of History at Australian National University: http://history.cass.anu.edu.au/people/tom%20griffiths

55 https://www.sheffield.ac.uk/aps/staff-and-students/acadstaff/beerling

56 https://www.newcastle.edu.au/profile/tom-griffiths

57 https://royalsociety.org/people/david-beerling-11064/

58 Ernest Shackleton, *The Heart of the Antarctic, Being the Story of the British Antarctic Expedition, 1907–1909*, Vol. I & II, W. Heinemann, London, 1909 and A. W. Greely, *Scientific Results of Shackleton's South Polar Expedition The Heart of the Antarctic by E. H. Shackleton; An Account of the First Journey to the South Magnetic Pole by T. W. Edgeworth David*, Science, New Series, **31**(1910)822–830.

59 See this book's section 14.1, Appendix I *Geographical Locations*.

60 Edward R. G. R. Evans, *South with Scott*, Collins, London, 1921, *cf.* p. 189.

61 Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R.F. Scott, R.N., C.V.O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 110.

62 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. II, *cf.* p. 320, 350, 352, respectively.

63 Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R.F. Scott, R.N., C.V.O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 352.

64 See also Edward R. G. R. Evans, *South with Scott*, Collins, London, 1921, *cf.* p. 139.

65 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. II, *cf.* p. 420.

66 It appears that Cherry-Garrard is incorrect in saying that the pony meat was present (depôted) at the Middle Glacier Depôt. One should recall that Meares' two dog teams, instead of returning from 81°15′S were taken by Captain Scott up to 83°36′S (Cherry-Garrard gives 83°35′S, see Vol. II, *cf.* p. 383), which is not the Middle Glacier Depôt's location at 84°17′S. It appears Cherry-Garrard confused the Middle <u>Barrier</u> with the Middle <u>Glacier</u> Depôts.

67 Ranulph Fiennes, *Captain Scott*, Hodder and Stoughton, London, 2003, *cf.* p. 361.

68 *Ibid*. Apparently Sir Ranulph's reference to Cherry-Garrard's text as taken from the Annotated Journal is unclear from his book. The only Cherry-Garrard publication given in Sir Ranulph's book is *The Worst Journey in the World*, which evidently does not contain the cited lines by Cherry-Garrard. Cherry–Garrard's journals are available at the Scott Polar Research Institute in files MS 559/19/1–4.

69 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, *cf.* Vol. II, p. 383.

70 Ernest Shackleton, *South: the Story of Shackleton's Last Expedition*, 1914–1917, The MacMillan Company, New York, 1920, *cf.* p. 2.

71 Notably there are cases to the contrary. One which to me appeals the most is the simultaneous scientific race of Albert Einstein and David Hilbert to find gravitational field equations in late October and late November 1915. For more information, see see John Earman and Clark Glymour, *Einstein and Hilbert: Two Months in the History of General Relativity* (1978). Department of Philosophy Paper 337. http://repository.cmu.edu/philosophy/337 and Ivan T. Todorov, *Einstein and Hilbert: The Creation of General Relativity*, http://arxiv.org/abs/physics/0504179 or any good book on A. Einstein.

72 https://web.archive.org/web/20120403155812/http://www.nhm.ac.uk/about-us/news/2012/january/scotts-south-pole-expedition-science-legacy107676.html

73 Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R.F. Scott, R.N., C.V.O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. xix.

74 Ranulph Fiennes, *Captain Scott*, Hodder & Stoughton, London, 2003, *cf.* p. 147.

75 Ibid., *cf.* p. 260.

76 Griffith Taylor, *Antarctic Geology*, The Mining Magazine **17**(1917)262–269, *cf.* p. 262.

77 Arnold E. Ortmann, *The Theories of The Origin of the Antarctic Faunas and Floras*, The American Naturalist **35**(1901)139–142.

78 For a list of references of the scientific reports of these expeditions, look at the end of the list of references of this book. Additionally, for review of original reports see: Jeffrey Stilwell and John Long, *Frozen in Time: Prehistoric Life in Antarctica*, Csiro Publishing, 2011; David J. Cantrill and Imogen Poole, *The Vegetation of Antarctica Through Geological Time*, Cambridge University Press, 2012.

79 Alfred Wegener, *Die Herausbildung der Grossformen der Erdrinde (Kontinente und Ozeane), auf Geophysikalischer Grundlage*, Petermanns Geographische Mitteilungen (in German) 63: 185–195, 253–256, 305–309, 1912; Presented at the annual meeting of the German Geological Society, Frankfurt am Main (Jan. 6th, 1912); Alfred Wegener, *Die Entstehung der Kontinente*, Geologische Rundschau **3**(1912)276–292 and Alfred Wegener, *Die Entstehung der Kontinente und Ozeane* [*The Origin of Continents and Oceans*], various German editions since the first in 1922 and http://de.wikisource.org/wiki/Die_Entstehung_der_Kontinente_und_Ozeane

80 Henry R. Frankel, *The Continental Drift Controversy: Wegener and the Early Debate*, Vol. I, Cambridge University Press, Cambridge, 2012; Roger M. McCoy, *Ending in Ice: Alfred Wegener's Revolutionary Idea and Tragic Expedition*, Oxford University Press, New York, 2006.

Chapter 10: **Silent Mutiny at Cape Evans**

pages 385 through 460

1 Sarah Wheeler, *Cherry: A Life of Apsley Cherry-Garrard*, Random House, New York, 2002, *cf.* p. 135.

2 Robert F. Scott, *Scott's Last Expedition: Being the Reports of the Journeys & the Scientific Work Undertaken by Dr. E. A. Wilson and the Surviving Members of the Expedition*, Vol. II, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 211.

3 George C. Simpson to Gilbert Thomas Walker, dated Feb. 20th, 1913, Science Museum at Wroughton Archives, MS 2012/79. Dr Walker was the director-general of meteorological observatories in India from 1904 to 1924.

4 L. Rayleigh, Phil. Mag. **27**(1914)100; see also A. Wallraff, A. V. Ustinov, V. V. Kurin, I. A. Shereshevsky, and N. K. Vdovicheva, *Whispering Vortices*, Phys. Rev. Lett. **84**(2000)151–154.

5 David Crane, *Scott of the Antarctic, A Life of Courage and Tragedy*, Alfred A. Knopf, 2005, *cf.* p. 9.

6 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. II, *cf.* p. 546.

7 Robert F. Scott, Letter to G. Simpson dated Nov. 24th, 1911, Scott Polar Research Institute MS 1483/3/2;D see also Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. II, *cf.* p. 335. It is interesting to notice at this moment that Cherry-Garrard in his citation of Captain Scott's letter is omitting *the most important* line "So don't forget that the [supplies] must be got to One Ton Camp, Lat 79½ somehow."

8 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. II, *cf.* p. 412.

9 George C. Simpson, *British Antarctic Expedition, 1910–1913, Meteorology*, Vol. I, *Discussion*, Thacker, Spink and Co, Calcutta, 1919, Vol. I, *cf.* p. viii.

10 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. II, *cf.* p. 412.

11 Ibid., *cf.* p. 347.

12 In here for simplicity, I am assuming that the returning parties were equally divided into 4 man parties.

13 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. II, *cf.* p. 398.

14 Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R.F. Scott, R.N., C.V.O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 128–129.

15 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. II, *cf.* p. 353.

16 Collin Bull and Pat F. Wright (Eds.), *Silas: The Antarctic Diaries and Memoir of Charles S. Wright*, Ohio State University Press, 1992, *cf.* p. 248–249.

17 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. II, *cf.* p. 381.

18 *Ibid.*, *cf.* p. 410.

19 Robert F. Scott, *Scott's Last Expedition: Being the Reports of the Journeys & the Scientific Work Undertaken by Dr. E. A. Wilson and the Surviving Members of the Expedition*, Vol. II, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 204.

20 Of course, by observing the state of ice in McMurdo Sound one could get some insight into possible dates.

21 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. II, *cf.* p. 411.

22 *Loc. cit*.

23 Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R.F. Scott, R.N., C.V.O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913,

Vol. I, *cf.* p. 406; Max Jones (Ed.), Journals: *Captain Scott's Last Expedition*, Oxford University Press, Oxford, 2006, *cf.* p. 408 and 471.

24 *Loc. cit.*

25 Robert F. Scott, *Scott's Last Expedition: Being the Reports of the Journeys & the Scientific Work Undertaken by Dr. E. A. Wilson and the Surviving Members of the Expedition*, Vol. II, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, Vol. II, *cf.* p. 204.

26 George C. Simpson, *British Antarctic Expedition, 1910–1913, Meteorology*, Vol. I, *Discussion*, Thacker, Spink and Co., Calcutta, 1919, Vol. I, *cf.* p. iv.

27 Edward R. G. R. Evans, *South with Scott*, Collins, London, 1921, *cf.* p. 244.

28 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. II, *cf.* p. 429.

29 Herbert G. Ponting, *The Great White South, Being an Account of Experiences with Captain Scott's South Pole Expedition and of the Nature Life of the Antarctic*, London, Duckworth, 1922, *cf.* p. 185.

30 Collin Bull and Pat F. Wright (Eds.), *Silas: The Antarctic Diaries and Memoir of Charles S. Wright*, Ohio State University Press, Athens, 1992, *cf.* p. 247.

31 *Ibid.*, *cf.* p. 252.

32 George C. Simpson to Gibert Thomas Walker, May 17^{th}, 1912, Science Museum at Wroughton Archives, MS 2012/76.

33 RMS Orama's route visited the port of Colombo, Ceylon (http://trove.nla.gov.au/ndp/del/page/1291506?zoomLevel=3). From here, Dr Simpson had a one week's journey to Simla, as per his letter to Walker, Science Museum at Wroughton Archives, MS 2012/79. The list of passengers for RMS Orama, including Dr Simpson and Ponting was also published in the Sydney Morning Herald, http://trove.nla.gov.au/ndp/del/article/15349404

34 William Henry Dines. *Mr. W. H. Dines, F.R.S*, Nature **121**(1928)65–66.

35 Sir William Napier Shaw (1845–1945) was a British meteorologist.

36 Charles Chree (1860–1928) was a British physicist.

37 George C. Simpson to Gilbert Thomas Walker, Feb. 20^{th}, 1913, Science Museum at Wroughton Archives, MS 2012/79.

38 George C. Simpson to Gilbert Thomas Walker, Feb. 23^{rd}, 1914, Science Museum at Wroughton Archives, MS 2012/82.

39 Unknown, *British Antarctic Expedition, 1910–1913*, Nature **106**(1920)526–528.

40 George C. Simpson, *The Meteorology of the Antarctic*, Nature **106**(1921)599.

41 George C. Simpson, *British Antarctic Expedition, 1910–1913, Meteorology*, Vol. I, *Discussion*, Thacker, Spink, and Co., Calcutta, 1919, *cf.* p. iii.

42 Ancestry.com *UK, Outward Passenger Lists, 1890–1960* [online database].

43 E. Gold, *George Clarke Simpson. 1878–1965*, Biographical Memoirs of Fellows of the Royal Society **11**(1965)156–175, *cf.* p. 166.

44 http://law2.umkc.edu/faculty/projects/ftrials/Bounty/bountycompany.html

45 Ranulph Fiennes, *Captain Scott*, Hodder and Stoughton, London, 2003, *cf.* p. 361.

46 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. II, *cf.* p. 409.

47 Robert F. Scott, *Scott's Last Expedition: Being the Reports of the Journeys & the Scientific Work Undertaken by Dr. E. A. Wilson and the Surviving Members of the Expedition*, Vol. II, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 204.

48 *Loc. cit.*

49 Edward R. G. R. Evans, *South with Scott*, Collins, London, 1921, *cf.* p. 157.

[50] Robert F. Scott, *Scott's Last Expedition: Being the Reports of the Journeys & the Scientific Work Undertaken by Dr. E. A. Wilson and the Surviving Members of the Expedition*, Vol. II, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 204.

[51] Krzysztof Sienicki, *A Note on Several Topics Related to Polar Regions*, The Issues of Polar Meteorology **21**(2011)39–76 available at http://ocean.am.gdynia.pl/p_k_p/prob_011.html) [Original link to my work has been changed and one has to follow: http://klimat.org.pl/pkp/pkp_21/Sienicki-pkp21.pdf or http://klimat.org.pl/pkp/prob_011.html]

[52] George C. Simpson, *Meteorology*, Vol. III, *Tables*, Harrison and Sons, Ltd., London, 1923.

[53] Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. II, *cf.* p. 402.

[54] Michael Smith, *An Unsung Hero: Tom Crean, Antarctic Survivor*, Collins Press, 2001.

[55] Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. II, *cf.* p. 402.

[56] Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R.F. Scott, R.N., C.V.O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 264.

[57] Robert F. Scott, *Scott's Last Expedition: Being the Reports of the Journeys & the Scientific Work Undertaken by Dr. E. A. Wilson and the Surviving Members of the Expedition*, Vol. II, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 205.

[58] *Loc. cit*.

[59] Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. II, *cf.* p. 415.

[60] Collin Bull and Pat F. Wright (Eds.), *Silas: The Antarctic Diaries and Memoir of Charles S. Wright*, Ohio State University Press, 1992, *cf.* p. 253.

[61] George C. Simpson, *Meteorology*, Vol. III, *Tables*, Harrison and Sons, Ltd., London, 1923, *cf.* p. 20.

[62] *Ibid*., *cf.* p. 81.

[63] George C. Simpson, *British Antarctic Expedition, 1910–1913, Meteorology*, Vol. I, *Discussion*, Thacker, Spink and Co., Calcutta, 1919, *cf.* p. viii.

[64] *Ibid*., *cf.* p. 79.

[65] Edward R. G. R. Evans, *South with Scott*, Collins, London, 1921, *cf.* p. 162.

[66] Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. II, *cf.* p. 412.

[67] Robert F. Scott, *Scott's Last Expedition: Being the Reports of the Journeys & the Scientific Work Undertaken by Dr. E. A. Wilson and the Surviving Members of the Expedition*, Vol. II, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 206.

[68] *Ibid*., *cf.* p. 205.

[69] Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. II, *cf.* p. 415.

[70] Robert F. Scott, *Scott's Last Expedition: Being the Reports of the Journeys & the Scientific Work Undertaken by Dr. E. A. Wilson and the Surviving Members of the Expedition*, Vol. II, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 205–206.

[71] Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. II, *cf.* p. 420.

[72] Robert F. Scott, *Scott's Last Expedition: Being the Reports of the Journeys & the Scientific Work Undertaken by Dr. E. A. Wilson and the Surviving Members of the Expedition*, Vol. II, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, 205.

[73] George C. Simpson, *Meteorology*, Vol. III, *Tables*, Harrison and Sons, Ltd., London, 1923, *cf.* Table 78, p. 675–677.

74 Robert F. Scott, *Scott's Last Expedition: Being the Reports of the Journeys* & *the Scientific Work Undertaken by Dr. E. A. Wilson and the Surviving Members of the Expedition*, Vol. II, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 211.

75 *Loc. cit.*

76 Robert F. Scott, Robert, Falcon, *Scott's Last Expedition: Being the Journals of Captain R.F. Scott*, *R.N., C.V.O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 215.

77 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922.

78 Edward R. G. R. Evans, *South with Scott*, Collins, London, 1921.

79 Reginald Pound, *Scott of the Antarctic*, Cassell, London, 1966, *cf.* p. 263.

80 Max Jones (Ed.), *Journals: Captain Scott's Last Expedition*, Oxford University Press, Oxford, 2006, *cf.* p. 463.

81 For a good biography of Lt Evans, see Reginald Pound, *Evans of the Broke*, Oxford University Press, London, 1963.

82 Max Jones (Ed.), *Journals: Captain Scott's Last Expedition*, Oxford University Press, Oxford, 2006, *cf.* p. 462, 464.

83 Roland Huntford, *The Last Place on Earth*, Modern Library, New York, 1999 (originally published by Atheneum, 1986), *cf.* p. 519.

84 *Loc. cit*.

85 Roland Huntford, *The Last Place on Earth*, Modern Library, New York, 1999 (originally published by Atheneum, 1986), *cf.* p. 457.

86 *Loc. cit*.

87 Ranulph Fiennes, *Captain Scott*, Hodder and Stoughton, London, 2003, *cf.* p. 307.

88 Michael Smith, *I Am Just Going Outside: Captain Oates, Antarctic Tragedy*, Spellmount Publishers, Staplehurst, 2006, *cf.* p. 198.

89 On the same page where he adds without any scrutiny comments about verbal orders fabricated by Roland Huntford, Michael Smith makes several exaggerations of distances and the weather conditions. Let me list them without commenting: (i) the return distance of the Second Return Party (Lt Evans Party) was *via* Corner Camp about 613.5 miles and not 750, (ii) Crean marched about 1198 miles and not 1500 miles before his last solo journey to Hut Point, (iii) On Jan. 4th, Captain Scott was about 135.5 miles from the Pole and not 150 miles as given by Smith, and (iv) On the day of parting the wind was not howling, as Smith writes. The actual weather conditions are given in Dr Simpson Volume III, on page 630. On the parting time of 21:30 of Jan. 3rd, the wind was 4 in the Beaufort scale – moderate breeze – small branches begin to move.

90 Diana Preston, *A First Rate Tragedy: Robert Falcon Scott and the Race to the South Pole,* Houghton Mifflin Co., Boston, New York 1998, and http://www.amheath.com/author.php?id=119

91 *Ibid*., *cf.* p. xi.

92 *Ibid*., *cf.* p. 180.

93 David Crane, *Scott of the Antarctic, A Life of Courage and Tragedy*, Alfred A. Knopf, New York, 2005, *cf.* p. 497.

94 *Loc. cit*.

95 Edward R. G. R. Evans, *South with Scott*, Collins, London, 1921.

96 For Lashly's diary, see Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. II, *cf.* p. 384–406.

97 Max Jones, *Journals: Captain Scott's Last Expedition*, Oxford University Press, Oxford, 2006, *cf.* p. 471.

98 Ranulph Fiennes, *Captain Scott*, Hodder & Stoughton, London, 2003, *cf.* p. 384–385.

99 *Ibid*., *cf.* p. 484.

100 http://query.nytimes.com/mem/archive-free/pdf?res=9507E3DC1F31E233A2575AC0A9659C946396D6CF

101 Ranulph Fiennes, *Captain Scott*, Hodder & Stoughton, London, 2003, *cf.* p. 157.

102 Ross MacPhee, *Race to the End: Amundsen, Scott, and the Attainment of the South Pole*, Sterling Publishing Co, New York, 2010, *cf.* p. 144.

103 *Ibid*., *cf.* p. 231.

104 Tor Bomann-Larsen, *Roald Amundsen*, The History Press, 2011, *cf.* p. 108.

105 Roland Huntford, *Race to the South Pole: The Expedition Diaries of Scott and Amundsen*, Continuum, London, 2010.

106 Tor Bomann-Larsen, *Roald Amundsen*, The History Press, 2011, *cf.* p. 107.

107 *Ibid*., *cf.* p. 369–371.

108 https://web.archive.org/web/20030816161224/http://www.aircareintl.org/history/ambrose1.htm

109 Chris Turney, *1912: The Year the World Discovered Antarctica*, Counterpoint, Berkley, 2012, *cf.* p. 131–132

110 http://www.christurney.com/assets/1912_detailed_sources.pdf

111 Karen May and George Lewis, *The Deaths of Roald Amundsen and the Crew of the Latham 47*, Polar Record **51**(2015)1–15.

112 *Ibid*., *cf.* p. 3.

113 *Ibid*., *cf.* p. 7.

114 *Ibid*., *cf.* p. 10.

115 https://www.law.cornell.edu/cfr/text/14/91.3

116 Karen May and George Lewis, *The Deaths of Roald Amundsen and the Crew of the Latham 47*, Polar Record **51**(2015)1–15, *cf.* p. 6.

117 C. G. Grey, Leonard Bridgman, and L. Howard Flanders (Eds.), *Jane's All the World's Aircraft*, Samson Low, Marston & Company Ltd, London, 1929, *cf.* p. 206c.

118 http://cambridgejournals.altmetric.com/details/3690374/twitter

119 For just three examples out of many, see:
http://utahrails.net/articles/ambrose.php
https://web.archive.org/web/20030816161224/http://www.aircareintl.org/history/ambrose1.htm
http://www.thedailybeast.com/articles/2015/08/01/the-teen-who-exposed-a-professor-s-myth.html

120 Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R.F. Scott, R.N., C.V.O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 409.

121 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. II, Vol. II., *cf.* p. 485.

122 George Seaver, *Edward Wilson of the Antarctic: Naturalist and Friend*, E. P. Dutton and Company Inc., New York, 1937, *cf.* p. 293.

123 Actually on Mar. 21st, 1912, it was Thursday of NZST. Captain Scott's entries of weekdays starting from Feb. 20th, 1912 are incorrect, since he twice used Monday for Feb. 19th (correct entry) and for Feb. 20th. From the latter date onward, the names of weekdays should be shifted by +1 (Monday → Tuesday).

124 *Much Friction in Scott Party*, New York Times, Feb. 14th, 1913, page 1.

125 http://trove.nla.gov.au/ndp/del/article/79121678

126 Max Jones (Ed.), *Journals: Captain Scott's Last Expedition*, Oxford University Press, Oxford, 2006.

127 *Ibid.*, *cf.* p. 457.
128 *Loc. cit.*
129 http://www.bl.uk/turning-the-pages/?id=12878b6a-36b9-44db-a940-365b21bfe524&type=book (accessed Aug. 27th, 2014).
130 Max Jones (Ed.), *Journals: Captain Scott's Last Expedition*, Oxford University Press, Oxford, 2006, *cf.* p. 457.
131 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. II, *cf.* p. 326.
132 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922.
133 This distance results from the distance between Hut Point and Minna Bluff, equal to about 50.75 miles.
134 Collin Bull and Pat F. Wright (Eds.), *Silas: The Antarctic Diaries and Memoir of Charles S. Wright*, Ohio State University Press, 1992.
135 Edward R. G. R. Evans, *South with Scott*, Collins, London, 1921.
136 Herbert G. Ponting, *The Great White South, Being an Account of Experiences with Captain Scott's South Pole Expedition and of the Nature Life of the Antarctic*, London, Duckworth, 1922.
137 Diana Preston, *A First Rate Tragedy: Robert Falcon Scott and the Race to the South Pole,* Houghton Mifflin Company, Boston, 1998.
138 Ranulph Fiennes, *Captain Scott*, Hodder and Stoughton, London, 2003.
139 Susan Solomon, *The Coldest March: Scott's Fatal Antarctic Expedition*, Yale University Press, 2001.
140 Susan Solomon and Charles R. Stearns, *On the Role of the Weather in the Deaths of R. F. Scott and his Companions*, PNAS **96**(1999)13012–13016.
141 The authors use decimal degrees to express latitude and longitude of geographical locations. However, their use of decimal degrees is not consistent with standard usage. In the discussed case of Captain Scott's last camp location, Drs Solomon and Stearns suggest "a tent at roughly 79.6°S, 170°E, about 170 miles from the safety of their base". Transcribing it into the proper notation, one should write the tent's location as (–79.6, 170). This location is equivalent to 79°36′S, 170°E, as compared to One Ton Depôt's location at 79°28½′S, 170°E. It means that according to Drs Solomon and Stearns, Captain Scott's last camp was 8½ miles from One Ton Depôt, which is nonsense. The same authors also say that the last camp was "170 miles from the safety". This figure translates to 147.6 geographical miles. Recalling that the distance between Hut Point (*via* Corner Camp) and One Ton Depôt was 118 miles, it gives the location of the last camp as 31.6 miles from One Ton Depôt.
142 If, according to Drs Solomon and Stearns, the distance to safety was 147.6 miles and the last camp was 11 miles from One Ton Depôt (*cf.* p. 30016), then its location is 136.6 miles from Hut Point.
143 Max Jones (Ed.), *Journals: Captain Scott's Last Expedition*, Oxford University Press, Oxford, 2006.
144 Max Jones, *The Last Great Quest: Captain Scott's Antarctic Sacrifice*, Oxford University Press, 2003. This is the distance from Cape Evans. Since the distance between Cape Evans and Hut Point is 10.7 miles, it gives 139 miles to One Ton Depôt. According to Dr Jones, this figure is attributed to Lt Evans. See reference 1 of Chapter Three of Dr Jones' book.
145 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. II, *cf.* p. 416.
146 Robert F. Scott, *Scott's Last Expedition: Being the Reports of the Journeys & the Scientific Work Undertaken by Dr. E. A. Wilson and the Surviving Members of the Expedition*, Vol. II, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 238.

147 The following locations of depôts are handwritten by Captain Scott in his original journal, available at the British Library website. The square brackets […] are mine, ½ (crossed) indicates that ½ was crossed by Captain Scott, and Δ indicates the differences between the true locations and those given by Captain Scott:

Corner Camp 78.3 [77°54′0″S] Δ = 10′
Bluff Camp 79 [79°] Δ = 0′
One Ton Depôt 79½ [79°28½′S] Δ = 1.5′
Mount Hooper [Upper Barrier] 80 ½ (crossed) 32 [80°32′] Δ = 0′
Middle Barrier Depot 81½ (crossed) 35 [81°35′] Δ = 0′
South Barrier Depot [Lower Barrier] 82 ½(crossed) 47′ [82°47′] Δ = 0′
Lower Glacier Depot 83 [83°30′] Δ = 30′

148 On Mar. 11th 1912, the party was at 80°24′S. It is 55½ miles from One Ton Depôt, and not 54 as given by Captain Scott. If Captain Scott arrived at the last camp on March 21st it means that 55½–11 = 44½. It means also that the party was sledging ~4½ (4.45) miles a day for 10 consecutive days. However, if one takes the actual last camp location from One Ton Depôt, then 55½ – 22 = 33½, which translates into 3½ miles per day.

149 http://www.christies.com/lotfinder/lot/charles-seymour-wright-4348033-details.aspx?

150 Robert F. Scott, *Scott's Last Expedition: Being the Reports of the Journeys & the Scientific Work Undertaken by Dr. E. A. Wilson and the Surviving Members of the Expedition*, Vol. II, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 237.

151 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. II, *cf.* p. 483.

152 Max Jones (Ed.), *Journals: Captain Scott's Last Expedition*, Oxford University Press, Oxford, 2006.

153 Roland Huntford, *Race to the South Pole: The Expedition Diaries of Scott and Amundsen*, Continuum, London, 2010.

154 http://www.antarctic-circle.org/dates.htm (accessed in January 2015)

155 Karen May, *Could Captain Scott have been Saved? Revisiting Scott's Last Expedition*, Polar Record **49**(2013)72–90.

156 http://thosewhodared.blogspot.com/2010/10/tryggve-gran-interview-with-roland.html

157 Robert F. Scott, *Scott's Last Expedition: Being the Reports of the Journeys & the Scientific Work Undertaken by Dr. E. A. Wilson and the Surviving Members of the Expedition*, Vol. II, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 237.

158 Collin Bull and Pat F. Wright (Eds.), *Silas: The Antarctic Diaries and Memoir of Charles S. Wright*, Ohio State University Press, 1992, *cf.* p. 345–346.

159 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd., London, 1922, Vol. II, *cf.* p. 483.

160 Robert F. Scott, *Scott's Last Expedition: Being the Reports of the Journeys & the Scientific Work Undertaken by Dr. E. A. Wilson and the Surviving Members of the Expedition*, Vol. II, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 238.

161 Edward R. G. R. Evans, *South with Scott*, Collins, London, 1921, *cf.* p. 253.

162 Rignot, E., J. Mouginot, and B. Scheuchl, *Ice Flow of The Antarctic Ice Sheet*, Science **333**(2011)1427–1430.

163 Lee, Choon-Ki, Ki-Weon Seo, Shin-Chan Han, Jaehyung Yu, and Ted A. Scambos, *Ice Velocity Mapping of Ross Ice Shelf, Antarctica by Matching Surface Undulations Measured by Icesat Laser Altimetry*, Remote Sensing of Environment **124**(2012)251–258.

164 http://nsidc.org/pmesdr/

165 Edward R. G. R. Evans, *South with Scott*, Collins, London, 1921, *cf.* p. 160–163.

166 *Ibid.*, *cf.* p. 155–157.

Volume III

(pages 461 through 690)

Chapter 11: Captain Robert F. Scott: An Apology

pages 463 through 587

1 For a great number of prints, see any arbitrary edition.
2 Stanisław Lem, *A Perfect Vacuum*, Northwestern University Press, 1999 and a great number of editions in Polish. It was originally published in Polish in 1971 under the title *Doskonała Próżnia*.
3 For a great number of prints, see any arbitrary edition.
4 Merriam-Webster and Encyclopædia Britannica.
5 Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R.F. Scott, R.N., C.V.O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 416.
6 *Loc. cit.*
7 David Crane, *Scott of the Antarctic, A Life of Courage and Tragedy*, Alfred A. Knopf, 2005, *cf.* p. 516.
8 Apsley, Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, *cf.* p. 574.
9 Edward R. G. R. Evans, *South with Scott*, Collins, London, 1921, *cf.* p. 74–75.
10 With the exception of the location of 82°19′S (Feb. 26th) where on Nov. 28th of the previous year "Chinaman made four feeds for the dogs, and I suppose we can count every other pony as a similar asset. It follows that the dogs can be employed, rested, and fed well on the homeward track."
11 Edward Atkinson in Robert F. Scott, *Scott's Last Expedition: Being the Reports of the Journeys & the Scientific Work Undertaken by Dr E. A. Wilson and the Surviving Members of the Expedition*, Vol. II, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 211.
12 Edward R. G. R. Evans, *South with Scott*, Collins, London, 1921, *cf.* p. 144.
13 See section 14.1 Appendix 1 – Geographical Locations.
14 Apparently the line "The main depot was laid in latitude 79.36° South, longitude 168° East," from Ernest Shackleton's book [Ernest Shackleton, *The Heart of the Antarctic, Being the Story of the British Antarctic Expedition, 1907–1909*, Vol. I & II, W. Heinemann, London, 1909, Vol. I, *cf.* p. 243] contains an error in giving the latitude which should be 79°36′S.
15 Ranulph Fiennes, *Captain Scott*, Hodder and Stoughton, London, 2003, *cf.* p. 212.
16 Walter Sullivan, *The South Pole Fifty Years After*, Arctic **15**(1962)174–178.
17 George C. Simpson, *Meteorology*, Vol. III, Tables, Harrison and Sons, Ltd., London, 1923, *cf.* p. 637–638, Table 72: Register of the Main Polar Party, Cape Evans to Pole and Back to 80°S., *cf.* p. 637.
18 *Ibid.*, *cf.* p. 661.
19 *Ibid.*, *cf.* p. 667.
20 Edward Wilson, Ann Savours (Ed.), *Diary of the Discovery Expedition*, Blandford Press, London 1966, *cf.* p. 150.
21 Roald Amundsen, *The South Pole: An Account of the Norwegian Antarctic Expedition in the Fram*, Vol. I and II, John Murray, London, 1912, Vol. II, *cf.* p. 35.
22 R. F. Scott, *Plans of the British Antarctic Expedition, 1910*, The Geographical Journal **36**(1910)11–20.

23 Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R.F. Scott, R.N., C.V.O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 128.
24 Michael Pearson, *Sledges and Sledging in Polar Regions*, Polar Record **31**(1995)3–24. For a general review, see: David C. Poole and Howard H. Erickson, *Highly Athletic Terrestrial Mammals: Horses and Dogs*, Comprehensive Physiology **1**(2011)1–37.
25 Roland Huntford, *The Last Place on Earth*, Modern Library, New York, 1999 (originally published by Atheneum, 1986), *cf.* p. 446.
26 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. II, *cf.* p. 347.
27 *Ibid.*, *cf.* p. 412.
28 Karen May and Sarah Airriess, *Could Captain Scott have been Saved? Cecil Meares and the 'Second Journey' that Failed*, Polar Record **51**(2015)260–273.
29 *Loc. cit.*
30 Edward R. G. R. Evans, *South with Scott*, Collins, London, 1921, *cf.* p. 172–173.
31 Robert F. Scott, Letter to G. Simpson dated 24 November 1911, Scott Polar Research Institute MS 1483/3/2. See also Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. II, *cf.* p. 335.
32 Roland Huntford, *The Last Place on Earth*, Modern Library, New York, 1999 (originally published by Atheneum, 1986).
33 See subsection 10.8.1 and/or Edward R. G. R. Evans, *South with Scott*, Collins, London, 1921, *cf.* p. 162.
34 Ranulph Fiennes, *Captain Scott*, Hodder and Stoughton, London, 2003, *cf.* p. 307.
35 David Crane, *Scott of the Antarctic, A Life of Courage and Tragedy*, Alfred A. Knopf, New York, 2006, *cf.* p. 555.
36 Diana Preston, *A First Rate Tragedy: Robert Falcon Scott and the Race to the South Pole,* Houghton Mifflin Company, Boston, 1998, *cf.* p. 180.
37 Stephanie Barczewski, *Antarctic Destinies: Scott, Shackleton, and the Changing Face of Heroism*, Hambledon Continuum, New York, 2007, *cf.* p. 75.
38 Susan Solomon, *The Coldest March: Scott's Fatal Antarctic Expedition*, Yale University Press, New Haven, 2001, *cf.* p. 169.
39 Sara Wheeler, *Cherry: A Life of Apsley Cherry-Garrard*, Random House, New York, 2002, *cf.* p. 131.
40 Michael Smith, *I Am Just Going Outside: Captain Oates, Antarctic Tragedy*, Spellmount Publishers, 2006, *cf.* p. 198.
41 Charles L. Lagerbom, *The Fifth Man: Henry R. Bowers*, Caedmon of Whitby, Whitby, 1999, *cf.* p. 173.
42 Susan Solomon, *The Coldest March: Scott's Fatal Antarctic Expedition*, Yale University Press, New Haven, 2001, *cf.* p. 169.
43 One must notice that the reference pages given by Dr Solomon are incorrect. Of the pages she cites, only page 178 even mentions Meares, and not in the context that Dr Solomon uses it in.
44 Edward R. G. R. Evans, *South with Scott*, Collins, London, 1921, *cf.* p. 153.
45 Max Jones (Ed.), *Journals: Captain Scott's Last Expedition*, Oxford University Press, Oxford, 2006, *cf.* p. 467; Roland Huntford, *Race to the South Pole: The Expedition Diaries of Scott and Amundsen*, Continuum, London, 2010, *cf.* p. 34.
46 One must notice that the reference pages given by Dr Solomon are incorrect. Of the pages she cites, only page 178 even mentions Meares, and not in the context that Dr Solomon uses it in.

47 Since we know that Cherry-Garrard helped in editing Captain Scott's journal, the editorial note # 19 added by Leonard Huxley is indeed telling. The note is citing Captain Scott's letter of October 1911 in which he describes that Cherry-Garrard just informed him that "I must not count on his navigational powers". A few lines later, Captain Scott formulates an excuse and adds, "of course there is not one chance in a hundred that he will ever have to consider navigation on our journey …" Thus, Huxley finds an excuse for Cherry-Garrard for not sledging south during his First Relief journey (see section 2.3). However, this is only a partial and misleading account. The word navigation has a wide meaning, as given by Captain Scott's 1 to 8 points of navigational skills cited in the main body of this subsection. I believe that Captain Scott, by accepting Cherry-Garrard's navigational handicap, meant navigational usage of a theodolite and not a compass.

48 Roland Huntford, *The Last Place on Earth*, Modern Library, New York, 1999 (originally published by Atheneum, 1986), *cf.* p. 454.

49 Efron Bradley, *Bootstrap Methods: Another Look at the Jackknife*, Ann. Statist. **7**(1979)1–26; http://www.stat.cmu.edu/~fienberg/Statistics36-756/Efron1979.pdf

50 Roland Huntford, *The Last Place on Earth*, Modern Library, New York, 1999 (originally published by Atheneum, 1986), *cf.* p. 462.

51 *Exmeridian* observation: an altitude observation made on a celestial object lying close to the observer's, Christopher G. Morris, *Academic Press Dictionary of Science and Technology*, Gulf Professional Publishing, Huston, 1992, *cf.* p. 789.

52 To be fair, one must observe that on certain dates Captain Scott was anxious: (Jan. 25th, 1912) "Thank God we found our Half Degree Depôt"; (Jan 26th, 1912) "Knowing there were two cairns at four mile intervals, we had little anxiety till we picked up the first far on our right, then steering right by a stroke of fortune, and Bowers' sharp eyes caught a glimpse of the second far on the left. Evidently we made a bad course outward at this part. There is not a sign of our tracks between these cairns, but the last, marking our night camp of the 6th, No. 59, is in the belt of hard sastrugi, and I was comforted to see signs of the track reappearing as we camped."

53 Arthur R. Hinks, *Notes on Determination of Position Near the Poles*, The Geographical Journal **35**(1910)299–303, *cf.* p. 303.

54 Indeed, Sir Clements' field (tacit) experience was telling him the right answer. However, he was not the first who effectively navigated without elaborate measurements and calculations of geographical location. In relation to Polar regions, Ferdinand von Wrangell (1797–1870) makes the point in his *Narrative of an Expedition to the Polar Sea, in the Years 1820, 1821, 1822, & 1823*, Tames Madden and Co., London, MDCCCXXXX, *cf.* p. 145–146:

"Before proceeding further with my narrative, I must mention the remarkable skill with which our sledge-drivers preserved the direction of their course, either when winding amongst large hummocks, or on the open unvaried field of snow, where there were no objects to direct the eye. They appeared to be guided by a kind of unerring instinct. This was especially the case with my Cossack driver, Sotnik Tatarinow, who had had great practice for many years. In the midst of the intricate labyrinths of ice, turning sometimes to the right and sometimes to the left, now winding round a large hummock, now crossing over a smaller one, among all the incessant changes of direction, he seemed to have a plan of them all in his memory, and to make them compensate each other, so that we never lost our main direction, and whilst I was watching the different turns, compass in hand, trying to resume the true route, he had always a perfect knowledge of it empirically. His estimation of the distances we had passed over reduced to a straight line, generally agreed with my determinations deduced from observed latitudes and the day's course. It was less difficult to preserve the true direction on a plain surface. To enable us to follow as straight a line as possible, we tried to fix our eyes on some remarkable piece of ice at a distance; if there was none such, we were

guided by the wavelike stripes of snow (sastrugi) which are formed, either on the plains on land or on the level ice of the sea, by any wind of long continuance. These ridges always indicate the quarter from which the prevailing winds blow. The inhabitants of the Tundras often travel to a settlement several hundred wersts [Imperial Russian unit of length, 1 km, (versta, верста) – KS] off, with no other guide through these unvaried wastes than the sastrugi. They know by experience at what angle they must cross the greater and the lesser waves of snow in order to arrive at their destination, and they never fail. It often happens that the true permanent sastruga has been obliterated by another produced by temporary winds, but the traveller is not deceived thereby, his practised eye detects the change, he carefully removes the recently drifted snow, and corrects his course by the lower sastruga and by the angle formed by the two. We availed ourselves of them on the level ice of the sea, for the compass cannot well be used while driving; it is necessary to halt in order to consult it, and this loses time. Where there were no sastrugi, we had recourse to the sun or stars when the weather was clear, but we always consulted the compass at least once in every hour."

55 Ernest Shackleton, *South: the Story of Shackleton's Last Expedition*, 1914–1917, The MacMillan Company, New York, 1920, *cf.* p. 176. It is certainly possible that Ernest Shackleton and Frank Worsley had in mind declinations measured by previous polar expeditions venturing into these regions. Additionally, measurements obtained by Captain Cook's second expedition and *Challenger Expedition* could have been used by Shackleton. However, I have no evidence for that.

56 Roald Amundsen, *The South Pole: An Account of the Norwegian Antarctic Expedition in the Fram*, Vol. I and II, John Murray, London, 1912, Vol. II, *cf.* p. 21.

57 *Ibid.*, *cf.* p. 25.

58 Roland Huntford, *Race to the South Pole: The Expedition Diaries of Scott and Amundsen*, Continuum, London, 2010, *cf.* p. 116.

59 Ernest Shackleton, *The Heart of the Antarctic, Being the Story of the British Antarctic Expedition, 1907–1909*, Vol. I & II, W. Heinemann, London, 1909, *cf.* p. 429.

60 On Jan. 3rd 1909, noon position 82°58′S, *Ibid.*

61 The following measurements were taken: 83°1′, 84°40′, 85°36′, 86°21′(23′), 86°47′, 88°9′, 88°16′, 88°25′, 89°15′, 89°37′ and 89°56′. All latitudes (?) are of course due South.

62 George Back, Francis Galton and Richard Collinson, (Eds.), *Hints to Travellers*, The Royal Geographical Society, London, 1878.

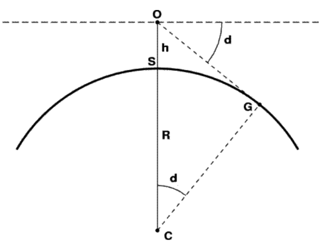
63 Robert F. Scott, *The Voyage of the 'Discovery'*, Vol. I and II, Toronto: The Copp, Clark Co., London: MacMillan and Co., 1905, Vol. II, *cf.* p. 187.

64 *Ibid.*, *cf.* p. 188.

65 Karen May, *Could Captain Scott Have Been Saved? Revisiting Scott's Last Expedition*, Polar Record **49**(2013)72–90.

66 See Captain Scott's journal entries for Feb. 27th, Mar. 2nd and Mar. 7th, 1912.

67 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. II, *cf.* p. 398.

68 

If the height (h) of Mount Erebus is 2.05 mile and the radius of Earth (R) is about 3444 miles then the distance to the horizon (OG) is 119 miles.

69 Michael Falk, Juerg Hüslerand and Rolf-Dieter Reiss, *Laws of Small Numbers: Extremes and Rare Events*, Springer, Berlin, 2010; Nassim N. Taleb, *The Black Swan: The Impact of the Highly Improbable Fragility*, Random House Digital, Inc., 2010.

70 Of course, $t \to \infty$ is a theoretical limit. In the case of climate, it is assumed since the 1935 meeting of the International Meteorology Organization in Warsaw (Poland) that "Climate is the average weather", and adopted the years 1901–1930 as the "climatic normal period". For more see at Spencer Weart, *Discovery of Global Warming – Climatology as Profession*, (2009); http://www.aip.org/history/climate/index.htm

71 G. W. F. Hegel, *Outlines of the Philosophy of Right*, Oxford University Press, Oxford, 2008; originally published in 1821.

72 George C. Simpson, *Meteorology*, Vol. III, Tables, Harrison and Sons, Ltd., London, 1923, *cf.* p. 625.

73 W. H. Dines, *Notes on the Readings of the Aspiration Psychrometer, and of the Dry and Wet Bulb Thermometers, and on the Observations of Evaporation and Precipitation, and of the Evaporation of Ice* in W. N. Shaw, *Meteorology: National Antarctic Expedition 1901–1904, Part I: Observations at Winter Quarters and on Sledge Journeys*, Royal Society, London, 1908, *cf.* p. 471. See also George C. Simpson, *British Antarctic Expedition, 1910–1913, Meteorology*, Vol. I, *Discussion*, Thacker, Spink and Co., Calcutta, 1919, *cf.* p. iv.

74 And a good number of miles in relays.

75 The figures of 1358 and 1347 miles were obtained under the assumption that the last camp was 11 and 22 miles from One Ton Depôt, respectively.

76 Ranulph Fiennes, *Captain Scott*, Hodder and Stoughton, London, 2003, *cf.* p. 417.

77 Stephanie Barczewski, *Antarctic Destinies: Scott, Shackleton, and the Changing Face of Heroism*, Hambledon Continuum, London, 2007, *cf.* p. 75.

78 "M.A., M.Phil., Ph.D. (with distinction), Yale University, a specialist in modern British history". Taken from http://people.clemson.edu/~sbarcze

79 Walter Sullivan, *The South Pole Fifty Years After*, Arctic **15**(1962)174–178. Sullivan wrongly suggested, "(3) The last-minute addition of Lieutenant Henry R. Bowers to the planned four-man pole party may have strained the rationing plans."

80 Roland Huntford, *The Last Place on Earth*, Modern Library, New York, 1999 (originally published by Atheneum, 1986), *cf.* p. 453.

81 *Loc. cit.*

82 Ranulph Fiennes, *Captain Scott*, Hodder and Stoughton, London, 2003, *cf.* p. 305.

83 *Ibid.*, Fig. 67.

84 This is my conjecture. I have no evidence that the Second Return Party took 1½ units to return to Upper Glacier Depôt. That was my initial assessment. However, after examining Captain Evans' book, I become aware of his short comment about food taken by his party.

85 Edward R. G. R. Evans, *South with Scott*, Collins, London, 1921, *cf.* p. 206, 212.

86 *Ibid.*, *cf.* p. 208.

87 Since the ration allotted is ¼ of the unit for 1 man and 1 week, it means $^{1}/_{28}$ of the unit for 1 man/day. Thus 8½ (days) × 3(man) × $^{1}/_{28} \approx {}^{9}/_{10}$ of 1.

88 Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R.F. Scott, R.N., C.V.O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 365.

89 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. II, *cf.* p. 499.

90 Walter Sullivan, *The South Pole Fifty Years After*, Arctic **15**(1962)175–178.

91 George C. Simpson, *Meteorology*, Vol. III, Tables, Harrison and Sons, Ltd., London, 1923, *cf.* p. 631 for Captain Scott's data and *cf.* p. 666 for Lt Evans' data.

92 Lt Bowers' diary cited after Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. II, *cf.* p. 499.
93 Susan Solomon, *The Coldest March: Scott's Fatal Antarctic Expedition*, Yale University Press, New Haven, 2001, *cf.* p. 195.
94 David Crane, *Scott of the Antarctic, A Life of Courage and Tragedy*, Alfred A. Knopf, New York, 2006, *cf.* p. 481.
95 From Captain Scott's *Message to the Public*.
96 Captain Scott's journal entry for Mar. 29th, 1912.
97 Arthur Conan Doyle, *The Sign of the Four*, many editions.
98 Provided some 10% less fuel due to tin leakage.
99 http://quoteinvestigator.com/2014/07/13/truth/
100 Stanisław Lem, *Solaris*, originally published in 1961 in Polish. Since then, in many editions including English.
101 *The British Antarctic Expedition*, Nature **90**(1913)649–650.
102 Daily Mirror, Feb. 12th, 1913, *cf.* p. 10–11.
103 Herbert G. Ponting, *The Great White South, Being an Account of Experiences with Captain Scott's South Pole Expedition and of the Nature Life of the Antarctic*, Duckworth, London, 1922, *cf.* p. 283.
104 Harold Avery, *"No Surrender!" The Story of Captain Scott's Journey to the South Pole*, Thomas Nelson and Sons Ltd, London, 1933, *cf.* p. 249.
105 http://www.telegraph.co.uk/culture/books/3633687/Ice-in-our-hearts.html
106 Colin Martin, *Scientists to the End*, Nature **481**(2012)264.
107 Pallab Ghosh, *Researchers Praise Scott's South Pole Scientific Legacy*, http://www.bbc.co.uk/news/science-environment-16530953, dated Jan. 17th, 2012.
108 Robert F. Scott, Robert, Falcon, *Scott's Last Expedition: Being the Reports of the Journeys & the Scientific Work Undertaken by Dr E. A. Wilson and the Surviving Members of the Expedition*, Vol. II, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 237.
109 http://en.wikipedia.org/wiki/Pallab_Ghosh
110 Clemens Markham, *The Lands of Silence*, (completed by Francis H. H. Guillemard), Cambridge University Press, Cambridge 1921, *cf.* p. 502 and 506, respectively.
111 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. II, *cf.* p. 546.
112 Tryggve Gran, *The Norwegian with Scott: Tryggve Gran's Antarctic Diary, 1910–1913*, Stationery Office Books, 1984, *cf.* p. 217.
113 John A. Long, *Case Studies of Intangible Natural Heritage from Museum Collections*, in E. Dorfman (Ed.), *Intangible Natural Heritage: New Perspectives on Natural Objects*, Routledge Press, New York, 2011, *cf.* p. 49.
114 Ranulph Fiennes, *Captain Scott*, Hodder and Stoughton, London, 2003, *cf.* p. 372.
115 Karen May and George Lewis, *'A kind of Suicide'? Errors and Misconceptions in Roland Huntford's Account of the Last Days of Scott's Polar Party*, Polar Record **50**(2014)156–164, *cf.* p. 161.
116 Susan Solomon, *The Coldest March: Scott's Fatal Antarctic Expedition*, Yale University Press, New Haven, 2001, *cf.* p. 280.
117 Karen May, *Could Captain Scott Have Been Saved? Revisiting Scott's Last Expedition*, Polar Record **49**(2013)72–90.
118 Karen May and George Lewis, *'A kind of suicide'? Errors and Misconceptions in Roland Huntford's Account of the Last Days of Scott's Polar Party*, Polar Record **50**(2014)156–164.
119 Karen May, *Could Captain Scott Have Been Saved? Revisiting Scott's Last Expedition*, Polar Record **49**(2013)72–90. Her work is incorrect on all counts. Let me only comment on her remark *detached* from the main article, concerning the personal communication of

June 15th, 2011 from R. K. Headland, Institute Associate of the Scott Polar Research Institute. Karen May commented, “Cherry-Garrard, however, could not navigate beyond the basic use of a compass [*sic*]. Fortunately, locating One Ton Depot would not require advanced navigational skills [*sic*]. According to Headland (R. K. Headland, personal communication, 15 June 2011), One Ton could be found easily [*sic*] on the southbound course, at a point where the peak of Mount Erebus (an active volcano, often identifiable by a crown of smoke) was just about visible. However, south of One Ton, the terrain [*sic*] soon devolves into a featureless white plain where a thorough knowledge of navigation is crucial. Beyond One Ton, Cherry-Garrard could not easily proceed.”

Every line in the above expound is incorrect. Cherry-Garrard supposedly could not navigate by compass (see section 2.3 and subsection 11.1.6). Indeed, navigating to One Ton Depôt and beyond was an easy task due to Captain Scott’s request of learning navigation by magnetic declination (see subsection 11.1.6), and due to the marker cairn line extending to the Mid Barrier Depot (see subsection 11.1.5). Since navigation on the Barrier is a 2D question, May by giving the direction South must specify initial the latitude and longitude of the departure location (point). For Karen May, by *going South* from Cape Evans, Hut Point, or Corner Camp, it would mean missing the One Ton Depôt by 73.4 km (39.6 geographical miles (gm)), 64.3 km (34.7 gm) and 75.8 km (40.9 gm), respectively. Of course, no one except Karen May can go south from Cape Evans and Hut Point. However, never go south with Karen May, because you will miss every food depôt. One should also notice that the *distance to the horizon* (without refraction) of Mount Erebus (3.794 km (2.05 gm)) is about 119 geographical miles – the exact distance between Hut Point (*via* Corner Camp) and One Ton Depôt. $OG = R \cdot \arccos(R/(R+h))$. Thus, Karen May’s comments based on Headland’s observation are practically and historically incorrect. Cherry-Garrard several times, for example, Vol. I, *cf.* p. lviii and 81, commented on seeing Mount Erebus at great distances. See also Ref. 67 in Chapter 11.

120 Max Jones, *The Last Great Quest: Captain Scott’s Antarctic Sacrifice*, Oxford University Press, Oxford, 2003, *cf.* p. 116.

121 Jason C. Anthony, *Hoosh: Roast Penguin, Scurvy Day, and other Stories of Antarctic Cuisine*, University of Nebraska Press, Lincoln, 2012.

122 For example http://nutritiondata.self.com/facts/lamb-veal-and-game-products/4639/2

123 A. R. Butler, *The Role of Scurvy in Scott’s Return from the South Pole*, The Journal of the Royal College of Physicians of Edinburgh **43**(2013)175–181. On page 180 of his article, Butler writes, “Significantly, Teddy Evans had spent more time away from base camp sledging than the others and would have been without fresh food for a longer amount of time.”

124 Roland Huntford, *The Last Place on Earth*, Modern Library, New York, 1999 (originally published by Atheneum, 1986), *cf.* p. 372.

125 *Ibid.*, *cf.* p. 493.

126 Henry G. Lyons, *British (Terra Nova) Antarctic Expedition 1910–1913: Miscellaneous Data*, Harrison and Sons, London, 1924.

127 Since the concentration of vitamin C in foods depends upon many natural and human caused factors.

128 Collin Bull and Pat F. Wright (Eds.), *Silas: The Antarctic Diaries and Memoir of Charles S. Wright*, Ohio State University Press, 1992, *cf.* p. 160, entry on Aug. 17th, 1911 right after Dr Atkinson’s lecture on scurvy.

129 Robert E. Hodges, *et al.*, *Experimental Scurvy in Man*, The American Journal of Clinical Nutrition **22**(1969)535–548.

130 Robert E. Hodges, James Hood, John E. Canham, Howerde E. Sauberlich, and Eugene M. Baker, *Clinical Manifestations of Ascorbic Acid Deficiency in Man*, The American Jour-

nal of Clinical Nutrition **24**(1971)432–443; *Ascorbic Acid – Survy*, Prog. Food. Nutr. Sci. **1**(1975)493–506; J. V. Hirschmann and G. J. Raugi, *Adult Scurvy*, Journal of the American Academy of Dermatology **41**(1999)895–906. For a recent (2012) review, see http://www.mv.helsinki.fi/home/hemila/history/#mozTocId107445 in references herein.

131 Oliver Fain, *Cerences en Vitamine C (Vitamin C Deficiency)*, Le Revue de Médecine Internce **25**(2004)872–880. The author gives 12+ weeks onset time for scurvy symptoms.

132 *Ibid*. Dr Fain concluded, "Scurvy occurs after 3 months without consumption of ascorbic acid, and is due to lack of consumption fresh fruits and vegetables. Clinical manifestations are weakness, myalgia and arthralgia, vascular purpura and hemorrhagic syndrome, and later the stomatologic manifestations: gingivorragia and loss of teeth. Biological signs are nonspecific: anemia, hypocholesterolemia, hypoalbuminemia."

133 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. II, *cf.* p. 396.

134 Susan Solomon, *The Coldest March: Scott's Fatal Antarctic Expedition*, Yale University Press, New Haven, 2001, *cf.* p. 279.

135 *Ibid.*, *cf.* p. 374.

136 *Ibid.*, *cf.* p. 280.

137 J. H. Crandon, C. C. Lund, and D. B. Dill, *Human Experimental Scurvy*, N. Engl. J. Med. **223**(1940)353–369.

138 K. J. Carpenter, *The History of Scurvy and Vitamin C*, Cambridge University Press, Cambridge, 1986, *cf.* p. 201.

139 *Ibid.*, *cf.* p. 202.

140 R. E. Hodges, E. M. Baker, J. Hood, H. E. Sauberlich and S. E. March, *Experimental Scurvy in Man*, Am. J. Clin. Nutr. **22**(1969)535–548.

141 K. J. Carpenter, *The History of Scurvy and Vitamin C*, Cambridge University Press, Cambridge, 1986, *cf.* p. 204.

142 R. E. Hodges, E. M. Baker, J. Hood, H. E. Sauberlich and S. E. March, *Experimental Scurvy in Man*, Am. J. Clin. Nutr. **22**(1969)535–548, *cf.* p. 546.

143 Robert E. Hodges, James Hood, John E. Canham, Howerde E. Sauberlich, and Eugene M. Baker, *Clinical Manifestations of Ascorbic Acid Deficiency in Man*, The American Journal of Clinical Nutrition **24**(1971)432–443.

144 *Ibid.*, *cf.* p. 439–440.

145 M. A. Allen and S. G. Burgess, *The Losses of Ascorbic Acid During the Large-scale Cooking of Green Vegetables by Different Methods*, Br. J. Nutr. **4**(1950)95–100.

146 Susan Solomon, *The Coldest March: Scott's Fatal Antarctic Expedition*, Yale University Press, New Haven, 2001, *cf.* p. 281.

147 *Loc. cit*.

148 *Loc. cit*.

149 The following sledging journeys were commenced by Captain Scott: Southern Journey (93 days), and Western Journey (59 days).

150 Susan Solomon, *The Coldest March: Scott's Fatal Antarctic Expedition*, Yale University Press, New Haven, 2001, *cf.* p. 281.

151 Max Jones, *The Last Great Quest: Captain Scott's Antarctic Sacrifice*, Oxford University Press, Oxford, 2003, *cf.* p. 116.

152 Ranulph Fiennes, *Captain Scott*, Hodder and Stoughton, London, 2003, *cf.* p. 372.

153 Karen May and George Lewis, *'A kind of suicide'? Errors and Misconceptions in Roland Huntford's Account of the Last Days of Scott's Polar Party*, Polar Record **50**(2014)156–164.

154 http://nutritiondata.self.com/facts/lamb-veal-and-game-products/4639/2

155 Ernest Shackleton, *The Heart of the Antarctic, Being the Story of the British Antarctic Expedition, 1907–1909*, Vol. I & II, W. Heinemann, London, 1909, Vol. I, *cf.* p. 294.

156 Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R.F. Scott, R.N., C.V.O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 265.
157 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. II, *cf.* p. 383.
158 *Ibid.*, *cf.* p. 425.
159 *Ibid.*, *cf.* p. 442.
160 *Ibid.*, p. 460–461.
161 Fain Olivier, *Cerences en Vitamine C (Vitamin C Deficiency)*, Le Revue de Médecine Interne **25**(2004)872–880.
162 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. I, *cf.* p. 217.
163 *Ibid.*, Vol. II, *cf.* p. 393.
164 A. F. Rogers, *The Death of Chief Petty Officer Evans*, The Practitioner **212**(1974)570–580. See also Robert E. Feeney, *Polar Journeys: The Role of Food and Nutrition in Early Exploration*, University of Alaska Press, Fairbanks, 1997, *cf.* p. 160.
165 *Loc. cit*.
166 Joseph R. Geraci and Thomas G. Smith, *Vitamin C in the Diet of Inuit Hunters from Holman, Northwest Territories*, Arctic **32**(1979)135–139, and references cited therein.
167 With the exception of ringed seal liver, as given in Table 1 of the above reference.
168 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. I, *cf.* p. 256.
169 Henry G. Lyons, *British (Terra Nova) Antarctic Expedition (1910–1913): Miscellaneous Data*, Harrison and Sons, London, 1924, *cf.* p. 49.
170 Robert F. Scott, *The Voyage of the "Discovery"*, Vol. I, The Copp, Clark Co., Limited, Toronto, 1905, *cf.* p. 324.
171 Ernest Shackleton, *The Heart of the Antarctic, Being the Story of the British Antarctic Expedition, 1907–1909*, Vol. I & II, W. Heinemann, London, 1909, Vol. I, *cf.* p. 10, 159.
172 Roald Amundsen, *The South Pole: An Account of the Norwegian Antarctic Expedition in the Fram*, Vol. I and II, John Murray, London, 1912, Vol. I, *cf.* p. 55.
173 Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R.F. Scott, R.N., C.V.O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 413.
174 SPRI MS 1/1/5/115 cited after David Crane, *Scott of the Antarctic: A Life of Courage and Tragedy*, Alfred A. Knopf, New York, 2006, *cf.* p. 505.
175 Karen May and Sarah Airriess, *Could Captain Scott have been Saved? Cecil Meares and the 'Second Journey' that Failed*, Polar Record **51**(2015)260–273.
176 If the entry was dated Mar. 21st, then it should have been Thursday.
177 http://www.christies.com/lotfinder/lot/british-antarctic-expedition-1862251-details.aspx
178 http://paperspast.natlib.govt.nz/cgi-bin/paperspast?a=d&cl=search&d=ODT19130320.2.39
179 Max Jones (Ed.), *Journals: Captain Scott's Last Expedition*, Oxford University Press, Oxford, 2006, *cf.* p. xlii.
180 Susan Solomon, *The Coldest March: Scott's Fatal Antarctic Expedition*, Yale University Press, New Haven, 2001, *cf.* p. 102.
181 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. II, *cf.* p. 547.
182 Beau Riffenburgh, *Nimrod: Ernest Shackleton and the Extraordinary Story of the 1907–09 British Antarctic Expedition*, Bloomsbury Publishing, London, 2005, *cf.* p. 110.
183 Roland Huntford *The Last Place on Earth*, Modern Library, New York, 1999 (originally published by Atheneum, 1986), *cf.* p. 505.

184 Roald Amundsen, *My Life as an Explorer*, Doubleday, Page and Company, Garden City, 1927, *cf.* p. 249.

185 All dates except the last one are from 1908. The last depot, Depôt **F** was a temporary storage depôt for the party in a dash to reach as far South as possible (88°23′S). At Depôt **F** the sledge and equipment were stored by Lt Shackleton.

186 William Faulkner, *The Sound and the Fury*, many different editions.

187 *Macbeth* 2.3.91–96.

188 Roland Huntford in *Race to the South Pole* for Captain Scott's diary entry on this day notes that the word „bitter" originally came after „Many" and was censored. Dr Max Jones notes this on page 470 of *Journals: Captain Scott's Last Expedition*, Oxford University Press, Oxford, 2006.

189 Roland Huntford, *Race to the South Pole: The Expedition Diaries of Scott and Amundsen*, Continuum, London, 2010, *cf.* p. 248.

190 June Debenham Back (Ed.), *The Quiet Land: The Antarctic Diaries of Frank Debenham*, Bluntisham Books and the Erskine Press, 1992, *cf.* p. 103–104.

191 Charles H. Lagerbom, *The Fifth Man: Henry R. Bowers*, Caedmon of Whitby, Whitby, 1999, *cf.* p. 190; Anne Strathie, *Birdie Bowers: Captain Scott's Marvel*, The History Press, 2013, *cf.* p. 213.

192 Edward R. G. R. Evans, *South with Scott*, Collins, London, 1952, *cf.* p. 191.

193 E. R. G. R. Evans, *The British Antarctic Expedition, 1910–13*, The Geographical Journal **42**(1913)11–28.

194 *Loc. cit*.

195 Commander Evans' expectation was based on his hidden assumption that along Captain Scott's route, there is present on the Barrier a positive temperature gradient between the Beardmore Glacier and Hut Point. This assumption is based on general knowledge from northern hemisphere observations, that at a given moment of time moving north generally meant a temperature decrease. Using this general climatological temperature behaviour from the northern hemisphere to account for temperature changes along Captain Scott's route is not justified, or based on the evidence available in 1913. Commander Evans also ignored the relationship between the velocity of the Captain Scott party and the velocity at which the winter was advancing. From Chapter 3, we know that the relationship location on the Barrier and temperature is complex and not described by a simple temperature gradient.

196 Admiral Lord Mountevans, *Man of the White South*, Thomas Nelson and Sons Ltd, 1958, *cf.* p. 82

197 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. II, *cf.* p. 524.

198 Stanisław Lem, *Return from the Stars* (*Powrót z Gwiazd*), originally published in 1961 in Polish. Since then, in many editions including English.

199 Stephen J. Pyne, *The Ice: A Journey to Antarctic*, University of Iowa Press, Iowa City, 1986.

200 Susan Solomon, *The Coldest March: Scott's Fatal Antarctic Expedition*, Yale University Press, New Haven, 2001, *cf.* p. 165.

201 Roald Amundsen, *My Life as an Explorer*, Doubleday, Page and Company, Garden City, 1927, *cf.* p. 71. See also Benedict Allen (Ed.), *The Faber Book of Exploration*, Faber and Faber, London, 2002, *cf.* p. 519.

202 George C. Simpson, *Scott's Polar Journey and the Weather*, Clarendon Press, Oxford, 1926.

203 The Glossary of Meteorology of American Meteorological Society: http://glossary.ametsoc.org/wiki/Dry-adiabatic_lapse_rate

204 Max Jones (Ed.), *Journals: Captain Scott's Last Expedition*, Oxford University Press, Oxford, 2006, *cf.* p. 490–491, explanatory note for page 220.

205 H. G. R. King (Ed.), *Edward Wilson: Diary of the Terra Nova Expedition to the Antarctic, 1910–1912*, Blanford Press, London, 1972, *cf.* p. 245.
206 R. F. Scott, *Scott's Last Expedition: Being the Journals of Captain R. F. Scott, R. N., C. V. O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 410.
207 Colin Martin, *Scientists to the End*, Nature **481**(2012)264.
208 This document provides guidelines on submission of Supplementary Information (SI), including the content of SI, the type of files they can accept, the size constraints for individual files and how SI should be presented. http://www.nature.com/nature/authors/submissions/final/suppinfo.html
209 Recently, related to the subjects discussed in this book, two publications appeared: Johanna C. Speirs, Hamish A. McGowan, Daniel F. Steinhoff, and David H. Bromwich, *Regional Climate Variability Driven by Foehn Winds in the McMurdo Dry Valleys*, Antarctica, International Journal of Climatology **33**(2013)945–958, accompanied by "*Comments on the Regional Climate Variability Driven by Foehn Winds in the McMurdo Dry Valleys, Antarctica* by Krzysztof Sienicki at http://arxiv.org/abs/1308.4630.
210 Captain Scott was not aware of the mutiny, though he could safely guess that the dogs were not coming. By this time, he was well north of the range of latitudes at which he was supposed to meet the dogs. Plus, he was well past the March 1st date that he should have met them at.

Chapter 12: Etiology of Captain Robert F. Scott's Death

pages 588 through 651

1 Kari Herbert, *Heart of the Hero: The Remarkable Women Who Inspired the Great Polar Explorers*, Saraband, 2012.
2 Latin adage: usefulness or utility as a principle in estimating the value of an act or policy [Merriam-Webster].
3 Edward R. G. R. Evans, *South with Scott*, Collins, London, 1921, *cf.* p. 237.
4 James M. Barrie, *The Admirable Crichton*, many different editions.
5 Henry Guly, *The Death of Robert Falcon Scott (1869–1912) and Colleagues*, Journal of Medical Biography **20**(2012)160–163; A. R. Butler, *The Role of Scurvy in Scott's Return from the South Pole*, The Journal of the Royal College of Physicians of Edinburgh **43**(2013)175–181; Timothy De Ver Dye, Heather Lane, and David Stam, *"Dreadful to Behold": Frostbite on the 1910–1913 British Antarctic Expedition*, American Journal of Public Health **100**(2010)2364–2365.
6 Émile Durkheim, *Suicide: A Study in Sociology*, The Free Press, Glencoe, Ill., 1951, *cf.* p. 217–240. Originally published in French in 1897 as *Le Suicide*.
7 Robert F. Scott, *Plans of the British Antarctic Expedition, 1910*, The Geographical Journal **36**(1910)11–20.
8 *America to Enter the Race for the South Pole*, New York Times Feb. 13th, 1910, *cf.* p. SM1; *Scott Too, Says Charcot*, New York Times Mar. 9th, 1912, *cf.* p. 5.
9 H. G. R. King (Ed.), *Edward Wilson: Diary of the Terra Nova Expedition to the Antarctic, 1910–1912*, Blanford Press, London, 1972, *cf.* p. xiii.
10 *Ibid.*, *cf.* p. 181–182.
11 Reginald Pound, *Scott of the Antarctic*, Cassell, London, 1967, *cf.* p. 173.
12 Anthony M. Johnson, *Scott of the Antarctic and Cardiff*, University College Cardiff Press, Cardiff, 1984, *cf.* p. 33.
13 Stephanie Barczewski, *Heroic Failure and the British*, Yale University Press, Yale, 2016, *cf.* p. 205.

14 J. Gordon Hayes, *Antarctica: A Treatise on the Southern Continent*, The Richards Press Limited, London, 1928, *cf.* p. 197–198.

15 T. Griffith Taylor, *With Scott: The Silver Lining*, Smith, Elder and Co, London, 1916, *cf.* p. 249.

16 Scott Polar Research Institute MS 797/1. The first page of the list is reproduced in H. G. R. King (Ed.), *Edward Wilson: Diary of the Terra Nova Expedition to the Antarctic, 1910–1912*, Blanford Press, London, 1972, *cf.* p. 213.

17 Max Jones, *The Last Great Quest: Captain Scott's Antarctic Sacrifice*, Oxford University Press, Oxford, 2003, *cf.* p. 74–75.

18 Edward J. Larson, *An Empire of Ice: Scott, Shackleton, and the Heroic Age of Antarctic Science*, Yale University Press, Yale, 2011, *cf.* p. 233–234.

19 *Ibid*., *cf.* p. 216.

20 George Murray (Ed.), *The Antarctic Manual for the Use of the Expedition of 1901*, Royal Geographical Society, London, 1901, *cf.* p. 177, 178.

21 http://yalebooks.com/book/9780300188219/empire-ice

22 http://www.pulitzer.org/winners/6861

23 http://www.spri.cam.ac.uk/shop/books/antarcticexploration.html

24 Roald Amundsen, *The South Pole: An Account of the Norwegian Antarctic Expedition in the "Fram," 1910–1912*, Vol. I and II, John Murray, London, 1912, Vol. II, *cf.* p. 159, 395–398.

25 Robert F. Scott, Robert, Falcon, *Scott's Last Expedition: Being the Journals of Captain R.F. Scott*, *R.N., C.V.O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 130.

26 http://www.nytimes.com/learning/general/onthisday/big/0118.html#article

27 Robert F. Scott, *Scott's Last Expedition: Being the Reports of the Journeys & the Scientific Work Undertaken by Dr. E. A. Wilson and the Surviving Members of the Expedition*, Vol. II, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, Vol. II, *cf.* p. 58.

28 Edward R. G. R. Evans, *South with Scott*, Collins, London, 1921, *cf.* p. 77.

29 George Murray, *The Antarctic Manual, for the Use of the Expedition of 1901*, Royal Geographical Society, London, 1901.

30 David Crane, *Scott of the Antarctic: A Life of Courage and Tragedy*, Alfred A. Knopf, New York, 2006, *cf.* p. 286.

31 Beau Riffenburgh, *Nimrod: Ernest Shackleton and the Extraordinary Story of the 1907–09 British Antarctic Expedition*, Bloomsbury Publishing, London, 2005, *cf.* p. 108–116.

32 Merriam-Webster: An Encyclopædia Britannica.

33 Robert F. Scott, *The Voyage of the ‚Discovery'*, Vol. I and II, Toronto: The Copp, Clark Co., London: MacMillan and Co., Vol. I, *cf.* p. 343.

34 *Ibid*., *cf.* p. 344.

35 Ernest Shackleton, *The Heart of the Antarctic, Being the Story of the British Antarctic Expedition, 1907–1909*, Vol. I & II, W. Heinemann, London, 1909, Vol. II, *cf.* p. 52–60.

36 In here it is understood that the dogs and ponies sledge without man assistance. Obviously it is a theoretical figure, but still an illustrative notion of self-sustained sledging limits and analysis.

37 Ernest Shackleton, *South: the Story of Shackleton's Last Expedition*, 1914–1917, The MacMillan Company, New York, 1920, *cf.* p. 113.

38 Ernst Shackleton's family motto *Fortitudine vincimus* (By endurance we conquer).

39 C. R. Markham letter to J. W. Gregory, Jan. 30th 1901. London: Royal Geographical Society Archive, RGS/AA/4/1/10.

40 Edward B. Poulton, *The British National Antarctic Expedition*, Science **13**(1901)890–897.

41 Bernard E. Leake, *The Life and Work of Professor J. W. Gregory FRS (1864–1932), Geologist, Writer and Explorer*, London, 2011, *cf.* p. 66.

42 Royal Geographical Society, CB4, Markham 13.04.1909. See also, David Crane, *cf.* p. 355.
43 Fort Worth Star-Telegram dated May 7th, 1911. http://www.readex.com/sites/default/files/wp-content/uploads/2011/12/BC-6-Fort-Worth-Star-Telegram-05-07-1911.jpg
44 Max Jones, *The Last Great Quest: Captain Scott's Antarctic Sacrifice*, Oxford University Press, 2003, *cf.* p. 100.
45 Hilton Young, *Robert Falcon Scott, 1912*, The Daily Telegraph Jan. 18th, 1937.
46 Roald Amundsen, *My Life as an Explorer*, Doubleday, Page & Company, New York, 1927, *cf.* p. 70.
47 Ernest Shackleton, *The Heart of the Antarctic, Being the Story of the British Antarctic Expedition, 1907–1909*, Vol. I & II, W. Heinemann, London, 1909, Vol. I, *cf.* p. 342.
48 Daniel N. Robinson, *Praise and Blame: Moral Realism and its Applications*, Princeton University Press, Princeton, 2009.
49 The investigative reader at this moment may also consult our favourite nonsense teller Dr Solomon, who in the following words commented on Dr Simpson's "insightful reasoning" [*cf.* p. 154]: "Simpson laid the groundwork for understanding the factors that control surface temperature in Antarctic winter [*sic*], the conditions that would determine the survival of any party trying to attain the Pole." Oh, if only it was possible! However, something else was certainly possible. It was that Dr Simpson somehow convinced Captain Scott that he should expect the weather to be like Lt Shackleton's weather during his attempt to reach the Pole, back in 1908–1909. After all, that was the only record of most of Captain Scott's route available to him.
50 Griffith Taylor, *With Scott: The Silver Lining*, Smith, Elder & Co., London, 1916, *cf.* p. 241.
51 Frank Debenham, *In the Antarctic: Stories of Scott's Last Expedition*, John Murray, London, 1952, *cf.* p. 132.
52 Edward R. G. R. Evans, *South with Scott*, Collins, London, 1921, *cf.* p. 1–2.
53 William S. Bruce, *Polar Exploration*, Williams and Norgate, London, 1911, *cf.* p. 236–237.
54 Charles Kuralt, *To the Top of the World: The adventures and misadventures of the Plaisted Polar Expedition, March 28–May 4, 1967*, Holt, Rinehart, and Winston, New York, 1968, *cf.* p. 15–16.
55 R. N. Rudmose Brown and H. J. Fleure, *Obituary: Hugh Robert Mill*, Geography **35**(1950)124–127.
56 Hugh R. Mill, *Ten Years of Antarctic Exploration*, Geographical Journal, **39**(1912)369–375 and Hugh R. Mill, *The Antarctic Expeditions of 1911–12*, Geographical Journal **39**(1912)453–458, Hugh R. Mill, *The Siege Of The South Pole: The Story of Antarctic Exploration,* Alston Rivers, 1905, Hugh R. Mill, *An Autobiography*, Longmans & Green 1951; Hugh R. Mill, *The Life of Sir Ernest Shackleton*, Heineman, 1923.
57 Ranulph Fiennes, *Captain Scott*, Hodder and Stoughton, 2003, *cf.* p. 30.
58 Hugh R. Mill, letter to John Scott Keltie, Apr. 7th, 1912 (Scott Polar Research Institute). Cited after Roland Huntford, *Scott and Amundsen*, Hodder & Stoughton, 1979, *cf.* p. 607.
59 With exceptions of the *Discovery Expedition* (1901–1904) and the *Gauss Expedition* (1901–1904), all remaining the Heroic Age Antarctica expeditions: Dr Otto Nordenskjöld's *Antarctic Expedition* (1901–1904), William Bruce's *Scotia Expedition* (1902–1904), Dr Jean-Baptiste Charcot's *Français Expedition* (1903–1905) and *Pourquoi Pas? Expedition* (1908–1910), Lt Shackleton's *Nimrod Expedition* (1907–1909), Captain Scott's *Terra Nova Expedition* (1909–1913), and Captain Amundsen's *Fram Expedition* (1909–1912) "were *private* [italics KS] enterprises organized by the explorers themselves and supported only to a very moderate extent, if at all, by public [government – KS]

funds." Cited after Hugh R. Mill, *Ten Years of Antarctic Exploration*, Geographical Journal, **39**(1912)369–375.

60 http://www.christies.com/lotfinder/books-manuscripts/british-antarctic-expedition-1910-1913-robert-falc-5605336-details.aspx

61 David M. Wilson, *The Lost Photographs of Captain Scott*, Little, Brown Book Group, 2011. Dr David M. Wilson is a great nephew of Dr Edward Wilson.

62 Letter by Dr Wilson, quoted in David Crane, *Scott of the Antarctic, A Life of Courage and Tragedy*, Alfred A. Knopf, New York, 2006, *cf.* p. 398.

63 David M. Wilson, *The Lost Photographs of Captain Scott*, Little, Brown Book Group, 2011.

64 Robert F. Scott, *Scott's Last Expedition: Being the Reports of the Journeys & the Scientific Work Undertaken by Dr. E. A. Wilson and the Surviving Members of the Expedition*, Vol. II, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, Vol. II, *cf.* p. 237.

65 Martin Lindsay, *The Epic of Captain Scott*, G. P. Putnam's Sons, New York, 1934, *cf.* p. 170.

66 Carl R. Trueman, *Histories and Fallacies: Problems Faced in the Writing of History*, Crossway, Illinois Wheaton, 2010, *cf.* p. 45.

67 Richard P. Feynman, *Cargo Cult Science*, Engineering and Science, June 1974, *cf.* p. 10. http://calteches.library.caltech.edu/51/2/CargoCult.pdf See also Richard P. Feynman, *Surely You're Joking, Mr. Feynman!: Adventures of a Curious Character*, arbitrary edition.

68 G. Murray (Ed.), *The Antarctic Manual for the Use of the Expedition of 1901*, Royal Geographical Society, London, 1901, *cf.* p. 182.

69 Lucy Jolin, *Heroes Frozen in Time*, CAM (Cambridge Alumni Magazine) 59, *cf.* p. 18.

70 http://www.lucyjolin.com/ accessed on March 30th, 2015. Jolin not only cannot write on quantum cryptography [*sic*, she has not an educated clue about the subject], but she cannot write about a man who could not learn how to use compass "Yes, Cherry-Garrard's penguin's egg may have proved useless, but as he urged his readers: "The desire for knowledge for its own sake is the one which really counts … And I tell you, if you have the desire for knowledge and the power to give it physical expression, go out and explore." Cherry-Garrard's and Jolin's craving for knowledge is indeed unsurpassed.

71 Julian Dowdeswell, *Right to Reply: Heroes Frozen in Time*, CAM (Cambridge Alumni Magazine) 60, p. 45.

72 Adrian Howkins, *Taylor's Valley: What the History of Antarctica's 'Heroic Era' Can Contribute to Contemporary Ecological Research in the McMurdo Dry Valleys*, Environment and History **22**(2016)3–28.

73 *Ibid., cf.* p. 14.

74 https://web.archive.org/web/20120403155812/http://www.nhm.ac.uk/about-us/news/2012/january/scotts-south-pole-expedition-science-legacy107676.htm

Her name only appears associated with this publication in a broken link to the same article: https://www.google.com/search?q=%22Scott%27s+South+Pole+expedition+science+legacy%22&ie=utf-8&oe=utf-8#safe=strict&q=%22da+silva%22%22Scott%27s+South+Pole+expedition+science+legacy%22

75 http://www.nhm.ac.uk/about-us/news/2012/january/scotts-south-pole-expedition-science-legacy107676.html

76 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. II, *cf.* p. 577.

77 Robert F. Scott, *The Voyage of the ,Discovery'*, Vol. I and II, Toronto: The Copp, Clark Co., London: MacMillan and Co., 1905, Vol. I, *cf.* p. 51.

78 C. W. Parsons, *Penguin embryos*, *cf.* p. 253–262 in *British Antarctic Terra Nova Expedition, 1910–1913*, Natural History Reports, Zoology, IV. No. 7. London, British Museum (Natural History), 1934.

79 P. D. Jones, *Antarctic Temperatures Over the Present Century – A Study of the Early Expedition Record*, J. Clim. **3**(1990)1193–1203.

80 David M. Wilson and David B. Elder, *Cheltenham in Antarctica*, Reardon Publishing, Cheltenham, 2000, *cf.* p. 89.

81 To say that, the authors must be insane, out of their minds, and uneducated. The act of comparing what is incomparable is by itself amiss. However, one should re-call a great many fundamental discoveries of the 20th century, like *for example* quantum mechanics, molecular biology, antibiotics, *etc*. and not to "link it" with Jurassic Park by Michael Crichton.

82 Robert F. Scott, *Scott's Last Expedition: Being the Reports of the Journeys & the Scientific Work Undertaken by Dr. E. A. Wilson and the Surviving Members of the Expedition*, Vol. II, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.*, p. 1.

83 Thomas H. Huxley, *Further Evidence of the Affinity Between the Dinosaurian Reptiles and Birds*, Q. J. Geol. Soc. London **27**(1870)12–31.

84 Edward Wilson, Ann Savours (Ed.), *Diary of the 'Terra Nova' Expedition to the Antarctic 1910–12*, London, Blandford Press, *cf.* p. 191.

85 C. W. Parsons, *Penguin Embryos*, *cf.* p. 253–262 in *British Antarctic Terra Nova Expedition, 1910–1913*. Natural History Reports, Zoology, IV. No. 7. London, British Museum (Natural History), 1934.

86 Ranulph Fiennes, *Captain Scott*, Hodder and Stoughton, London, 2003, *cf.* p. 254.

87 Cape Crozier photo in Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R.F. Scott, R.N., C.V.O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* after *cf.* p. 54.

88 G. Murray Levick, *Antarctic Penguins: A Study of Their Social Habits*, McBride Nast and Company, New York, 1914, G. Murray Levick, *Natural History of the Adélie Penguin*, British Antarctic (*Terra Nova*) Expedition, 1910, Natural History Report, Zoology, London, 1915, Vol. I, *cf.*, p. 55–84.

89 We know that with no orders from Dr Wilson and Captain Scott to collect Adélie penguin hatched eggs, the *Northern Party* arrived at Cape Adare on Feb. 17th, 1911 and left it on Jan. 4th, 1912 to be transferred by the *Terra Nova* to Evans Cove for further geological work.

90 Robert F. Scott, *Scott's Last Expedition: Being the Reports of the Journeys & the Scientific Work Undertaken by Dr. E. A. Wilson and the Surviving Members of the Expedition*, Vol. II, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 2.

91 Olivier Heaviside, *Electromagnetic Theory*, Vol. II, "The Electrician" Printing and Publishing Company, London, 1899, *cf.* p. 9 and *cf.* p. 461.

92 Martin Lindsay, *The Epic of Captain Scott*, G. P. Putnam's Sons, New York, 1934, *cf.* p. 151.

93 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. I, *cf.* p. 128.

94 Didier Sornette and Peter Cauwels, *A Creepy World*, http://arxiv.org/ftp/arxiv/papers/1401/1401.3281.pdf

95 Reginald Pound, *Scott of the Antarctic*, Cassell, London, 1966, *cf.* p. 263.

96 Harry Ludlam, *Captain Scott: The Full Story*, W. Foulsham, London, 1965, *cf.* p. 127.

97 Reginald Pound, *Evans of the Broke*, Oxford University Press, London, 1963, *cf.* p. 58–59.

98 Arthur George Maynard Hesilrige, *Debrett's Peerage, Baronetage, Knightage, and Companionage*, Dean and Son, 1913, *cf.* p. xx–xxi.

99 http://trove.nla.gov.au/ndp/del/article/177806182

100 Arthur George Maynard Hesilrige, *Debrett's Peerage, Baronetage, Knightage, and Companionage*, Dean and Son, 1931, *cf.* p. 119.

101 https://www.thegazette.co.uk/London/issue/27346/page/5409
https://www.thegazette.co.uk/London/issue/27729/page/7023

102 https://www.thegazette.co.uk/London/issue/28049/page/5447
https://www.thegazette.co.uk/London/issue/28271/page/5461
103 https://www.thegazette.co.uk/London/issue/28719/page/3507
104 http://newspapers.library.wales/view/3764857/3764864/95/
105 https://www.thegazette.co.uk/London/issue/28321/page/9763
106 Karen May and George Lewis, *'A kind of Suicide'? Errors and Misconceptions in Roland Huntford's Account of the Last Days of Scott's Polar Party*, Polar Record **50**(2015)156–164.
107 http://www.royal.gov.uk/MonarchUK/Honours/RoyalVictorianOrder.aspx
108 James C. Risk, *The History of the Order of the Bath and its Insignia*, Spink and Son Ltd., 1972, *cf.* p. 92–93.
109 http://newspapers.library.wales/view/4425422/4425425/31/
110 *The Navy List*, H. M. Stationery Office, London, 1908, *cf.* p. 906.
111 http://newspapers.library.wales/view/4424193/4424196/39/
112 http://newspapers.library.wales/view/4424184/4424192/131/
113 Anthony M. Johnson, *Scott of the Antarctic and Cardiff*, University College Cardiff Press, 1984, *cf.* p. 55–59.
114 *Ibid.*, *cf.* p. 57.
115 *The Navy List*, H. M. Stationery Office, London, 1908, *cf.* p. 90.
116 *Ibid.*, *cf* p. 88–89. The persons in question are H.S.H. Prince Louis Alexander of Battenberg, G.C.B., G.C.V.O., G.C.M.G.; Sir Henry Deacon Barry, K.C.V.O.; Sir Percy Moreton Scott, K.C.V.O; Sir Alfred Wyndham Paget, K.C.M.G.; Sir Henry Bradwardine Jackson, K.C.V.O., F.R.S.; Sir John Rushworth Jellicoe, K.C.V.O., C.B.
117 Reginald Pound, *Evans of the Broke*, Oxford University Press, London, 1963, *cf.* p 235.
118 Robert F. Scott, *Scott's Last Expedition: Being the Journals of Captain R.F. Scott, R.N., C.V.O.*, Vol. I, Dodd, Mead & Company, The University Press, Cambridge, USA, 1913, *cf.* p. 412.
119 George Thomas Vince (Sep. 25th, 1879 – Mar. 2nd, 1902) is the first man to have lost his life in McMurdo Sound (Danger Slopes at 77°49′S, 166°40′E). He was one of a party of nine men who had caught out in a blizzard during an excursion from the *Discovery* ship, and slipped down before falling over the cliffs into the sea. His body was never recovered. See Robert F. Scott, *The Voyage of the ‚Discovery'*, Vol. I and II, Toronto: The Copp, Clark Co., London: MacMillan and Co., 1905, Vol. I, *cf.* p. 174.
120 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. II, *cf.* p. 520.
121 Émile Durkheim, *Suicide: A Study in Sociology*, The Free Press, Glencoe, Ill., 1951, *cf.* p. 216. Originally published in French in 1897 as *Le Suicide*.
122 Jocelyn J. Bélanger, Julie Caouette, Keren Sharvit, and Michelle Dugas, *The Psychology of Martyrdom: Making the Ultimate Sacrifice in the Name of a Cause*, J. Pers. Soc. Psychol. **107**(2014)494–515; Tom Pyszczynski, Abdolhossein Abdollahi, Sheldon Solomon, Jeff Greenberg, Florette Cohen, and David Weise, *Mortality, Salience, Martyrdom, and Military Might: The Great Satan Versus the Axis of Evil*, Pers. Soc. Psychol. Bull. **32**(2006)525–537; Demetrios J. Constantelos, *Altruistic Suicide or Altruistic Martyrdom? Christian Greek Orthodox Neomartyrs: A Case Study*, Archives of Suicide Research **8**(2004)57–71.
123 Edward R. G. R. Evans, *South with Scott*, Collins, London, 1921, *cf.* p. 237–238.
124 Roland Huntford, *The Last Place on Earth*, Modern Library, New York, 1999 (originally published by Atheneum, 1986), *cf.* p. 272.
125 Edward R. G. R. Evans, *South with Scott*, Collins, London, 1921, *cf.* p. 237.
126 *Loc. cit.*
127 Daily Mirror, Feb. 12th, 1913, *cf.* p. 10–11.

128 Roland Huntford, *The Last Place on Earth*, Modern Library, New York, 1999 (originally published by Atheneum, 1986), *cf.* p. 250.

129 Ernest Shackleton, *The Heart of the Antarctic, Being the Story of the British Antarctic Expedition, 1907–1909*, Vol. I & II, W. Heinemann, London, 1909, Vol. I, *cf.* p. 327.

130 *Ibid*., Vol. II, *cf.* p. 315.

131 Colin Bull and Pat F. Wright, *Silas: The Antarctic Diaries and Memoir of Charles S. Wright*, Ohio State University Press, 1992, *cf.* p. 225.

132 *Ibid*., *cf.* p. 303.

133 http://www.christies.com/lotfinder/fossils-minerals/british-antarctic-expedition-1910-13-5349808-details.aspx?pos=120&intObjectID=5349808&sid=#top

134 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. II, *cf.* p. 521.

135 G. Murray, (Ed.), *The Antarctic Manual for the Use of the Expedition of 1901*, Royal Geographical Society, London, 1901, *cf.* p. 182.

136 In here, Captain Scott is renaming it when its original name was Cathedral Rocks {83°36′S, 170°45′E}, given by Lt Shackleton in 1908. Currently, this rock formation is officially named Granite Pillars. See Figs. 9.6 and 12.3. The Granite Pillars are on the right side of the picture "facing" Mt Hope on the left side. In reality, Granite Pillars are a little further south than Mount Hope/Hope nunatak.

137 Captain Scott's entry date "*Monday, March 19*" is incorrect. Actually Mar. 19$^{\text{th}}$, 1912 was a Tuesday.

138 Colin Bull and Pat F. Wright, (Eds.), *Silas: The Antarctic Diaries and Memoir of Charles S. Wright*, Ohio State University Press, 1992, *cf.* p. 170.

139 H. G. R. King (Ed.), *Edward Wilson: Diary of the Terra Nova Expedition to the Antarctic, 1910–1912*, Blanford Press, London, 1972, *cf.* p. xiii.

140 Apsley Cherry-Garrard *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. II, *cf.* p. 340.

141 Michael Smith, *I Am Just Going Outside*, Spellmount Publishers, 2002, *cf.* p. 263.

142 Roland Huntford, *The Last Place on Earth*, Modern Library, New York, 1999 (originally published by Atheneum, 1986), *cf.* p. 518.

143 In here the investigative reader may notice that *if* Dr Wilson was keeping his diary, he could have written about Captain Oates' condition and symptoms.

144 Henry Bowers, letter to Mrs Emily Bowers, March 1912. David Crane, *Scott of the Antarctic: A Life of Courage and Tragedy*, Alfred A. Knopf, New York, 2006, *cf.* p. 505.

145 Krzysztof Sienicki, *A Note on Several Meteorological Topics Related to Polar Regions*, The Issues of Polar Meteorology **21**(2011)39–76, available at http://ocean.am.gdynia.pl/p_k_p/pkp_21/Sienicki-pkp21.pdf [Original link to my work has been changed and one has to follow: http://klimat.org.pl/pkp/pkp_21/Sienicki-pkp21.pdf or http://klimat.org.pl/pkp/prob_011.html] and http://arxiv.org/abs/1011.1272 (pre-print).

146 http://trove.nla.gov.au/ndp/del/article/117965848

147 Merriam-Webster.

148 Carl R. Trueman, *Histories and Fallacies: Problems Faced in Writing of History*, Crossway, Wheaton, 2010, *cf.* p. 45.

149 Eugene Garver, *For the Sake of Argument: Practical Reasoning, Character, and the Ethics of Belief*, University of Chicago Press, Chicago, 2004, *cf.* p. 195.

150 A. Egeland and C. S. Deehr, *Roald Amundsen's contributions to our knowledge of the magnetic fields of the Earth and Sun*, Hist. Geo Space Sci. **2**(2011)99–112; Aant Elzinga, *Roald Amundsen and his Ambiguous Relationship to Science: A Look at Outcomes of his Six Expeditions*, Journal of Northern Studies **6**(2012)53–109; Arnoldus S. Blix, *On Roald Amundsen's scientific achievements*, Polar Research **35**(2016)31319, http://dx.doi.org/10.3402/polar.

v35.31319. The first citation incorrectly lists Captain Amundsen as suffering carbon monoxide poisoning during the *Northwest Passage Expedition*, when this actually happened during the *Maud Expedition*. In contrast to Blix, I only accept the Norwegian term *videnskapsmann* as "scientist," since it requires a scientific method, whereas *forsker* does not. By this definition, Captains Amundsen and Scott were not scientists.

151 Procedures for Dealing with Academic Misconduct in Research and Scholarship, http://web.mit.edu/policies/10/`10.1.html

152 http://www.nap.edu/openbook.php?record_id=4917&page=16

153 Kari Herbert, *Heart of the Hero: The Remarkable Women Who Inspired the Great Polar Explorers*, Saraband, 2012 and Louisa Young, *A Great Task of Happiness: The Life of Kathleen Scott*, London, Macmillan, 1995, *cf.* p. 156–157.

154 The polar party did return to the glacier in fine form and with a surplus of food; P. O. Evans had nothing to do with their demise; I am certain that for his own sake Captain Scott regretted his journey, knowing that he could not see another way out.

155 P. D. Jones, *Antarctic Temperatures Over the Present Century – A Study of the Early Expedition Record*, J. Climate **3**(1990)1193–1203.

156 Dr Jones' figure of annual mean temperature at Cape Evans for the *Ross Sea Party* for the year 1915 as given in his Table 6 is incorrect, and instead of –16.1°C it should be –18.2°C. Dr Jones' uncorrected and corrected *annual* mean temperature is erroneous, as it is calculated from Mar. 23rd [*sic*] through Dec. 31st, 1915 as reported in Fritz Loewe's report, Table I, page 29 as referenced below. The investigative reader should also notice that the *Ross Sea Party*'s meteorological data saw the light of day in February 1963. That alone speaks for fellow scientists' interest in these data.

157 Susan Solomon, *The Coldest March: Scott's Fatal Antarctic Expedition*, Yale University Press, Yale, New Haven, 2001, *cf.* p. 300.

Appendixes

pages 656 through 690

1 Susan Solomon and Charles R. Stearns, *On the Role of the Weather in the Deaths of R. F. Scott and his Companions*, Proceedings of the National Academy of Sciences of the United States of America (PNAS) **96**(1999) 13012–l3016.

2 http://www.pnas.org/content/96/23/13012.full.pdf

3 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, *cf.* p. 574.

4 http://web.mit.edu/policies/10/10.1.html

5 *National Antarctic Expedition 1901–1904. Meteorology: Part I Observations at Winter Quarters and on Sledge Journeys with Discussions by Various Authors*, The Royal Society, London, 1908.

6 George C. Simpson, *Meteorology*, Vol. III, *Tables*, Harrison and Sons, Ltd., London, 1923, *Table 69. Register of Winter Journey to Cape Crozier and Back*, *cf.* p. 606–613. The correct temperature data are taken form *Dry Bulb.* or *Remarks* column of Table 69.

7 *Ibid*., *cf.* p. 151. Figure 32 caption.

8 *Ibid*., *cf.* p. 607.

9 *Ibid*., *cf.* p. 37.

10 *Ibid*., *cf.* p. 161.

11 *Ibid*., *cf.* p. 614.

12 http://ori.hhs.gov/definition-misconduct and 42 Code of Federal Regulations Sec. 689.1(a).

13 http://www.nsf.gov/oig/report-fraud/

14 http://eapsweb.mit.edu/news/2012/eaps-author-night-susan-solomon

15 *Loc. cit.*

16 http://web.mit.edu/policies/10/10.1.html

17 http://scienceblogs.com/ethicsandscience/2006/10/30/what-ever-happened-to-luk-van

Coda

pages 691 through 693

1 Ernest Hemingway

2 Brian W. Aldiss, *Non-Stop*, many editions including the U. S. edition's title *The Starship*.

3 "I do not know what I may appear to the world, but to myself I seem to have been only like a boy playing on the sea-shore, and diverting myself in now and then finding a smoother pebble or a prettier shell than ordinary, whilst the great ocean of truth lay all undiscovered before me." Isaac Newton.

4 John. D. Barrow and Frank J. Tipler, *The Anthropic Cosmological Principle*, Oxford University Press, Oxford, 1988.

5 http://english.lem.pl/faq#P.K.Dick

6 See for example: http://plato.stanford.edu/entries/mathematics-constructive/

Interview

pages 694 through 708

1 K. Sienicki and M. A. Winnik, *Transient Effects in Monomer–Excimer Kinetics*, The Journal of Chemical Physics **87**(1987)2766–2772 and K. Sienicki and G. Durocher, *Time-dependent Chemical Reactions: A Revision of Monomer–Excimer Kinetics?*, The Journal of Chemical Physics **94**(1991)6590–6597.

2 According to Edward R. G. R. Evans, *South with Scott*, Collins, London, 1921, *cf.* p. 106 "Simpson, for example, would employ as many volunteers as he could get to follow the balloons which he frequently sent up to record temperature and pressure. To each of these balloons a fine silk thread was attached, or rather the thread was attached to the little instrument it carried. When any strain was put on the thread it broke the thread connecting the small temperature and pressure instrument to the balloon, the former dropped on to the ice and was recovered by one of the volunteers, who followed the silk thread up until he came to the instrument where it had fallen. One required good eyesight for this work as for everything else down here, and I have never ceased to marvel at the way Cherry-Garrard got about and worked so well when one considers that he was very short-sighted indeed."

3 Apsley Cherry-Garrard, *The Worst Journey in the World: Antarctic 1910–1913*, Vol. I & II, Constable & Company Ltd, London, 1922, Vol. II, *cf.* p. 520–521.

4 http://www.homeofheroes.com/wings/erwin.html